Confidential

# MINUTES OF THE PROCEEDINGS

20 JAN 13054

OF THE

# METEOROLOGICAL COMMITTEE,

## 1869.

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# ERRATA.

Page 38. S. Spencer *to be* A. D. Spencer.
„ „ G. Brodie „ F. Brodie.
„ 54. E. James „ W. G. James.

# METEOROLOGICAL COMMITTEE.

13, *Ashley Place, Monday, 11th January* 1869.

PRESENT:

General Sabine in the chair.

Dr. W. A. Miller. | Mr. Gassiot.

Mr. Galton.

The Director and the Secretary to the Committee were in attendance.

The minutes of the last meeting were read and confirmed.

The report on the agencies at outports submitted at last meeting was approved, and the suggestions contained in it were ordered to be carried out.

Mr. Scott reported that having received the sanction of the Board of Trade to the issue of lithographed copies of the Daily Weather Report, at the annual cost of 2*l.* 10*s.* (see Minutes, Dec. 21, 1868), he had offered them to Mr. Griffith who had accepted the proposal.

Dr. Miller submitted the following resolution :—

Resolved—That having read Capt. Toynbee's "Report on the use of Isobaric Curves, &c.," submitted to them on the 26th October, the members of the Committee desire to express their unanimous sense of the great intelligence evinced by the paper, and of the amount of labour bestowed on it by its author, as well as of the value which investigations such as this must have when they are based on a sufficiently extensive induction.

The paper itself is mainly of a speculative nature and leads as yet to no definite practical results, so that it is scarcely fitted for publication in any form as emanating from an officer belonging to their staff.

The Committee therefore feel themselves reluctantly compelled to return it to Capt. Toynbee, thanking him for having given them the opportunity of perusing it, and assuring him that they feel confident that they are best consulting his scientific interests, in advising him not to press for its appearance in any form until he shall have proved by a far more extensive induction the accuracy of every conclusion and the applicability of every practical rule at which he states he has arrived.

Mr. Scott submitted the following notes on the Discussion of the Curves furnished by the Self-recording Instruments, with reference to weather :—

Having considered carefully the subject referred to me on the 6th July last, I have thought it best to examine the curves for a definite period of time, in order to see what information could be most easily derived from them with reference to the progress of weather.

I selected the period from September 19 to 30, inclusive.

The materials at my disposal were :—

Anemograms from all the observatories, except Armagh.
Thermograms " " " but Valencia.
Barograms from all but Valencia and Armagh.

No Daily Journals whatever have been received for the month of September.

There are many and serious gaps in these records, some of which have already been submitted to you. Minutes, 1868, p. 85.

The Thermogram from Falmouth, September 23 and 24, is almost unintelligible.

The curves and tabulations have been examined, and a series of charts made by Mr. Gaster.

The period named comprises several storms, some of which appear to present peculiar features, and on looking at the curves I find that they do not afford anything like a complete view of the meteorological conditions of these islands. Even if we had the Irish barograms, the stations are too far apart for us to trace the progress of any change by means of them alone. I have accordingly taken the Daily Weather Reports as a basis, and have compared the curves with them, in order to see whether any peculiarities noticed in the latter were only local disturbances, or were of greater magnitude, and such as would exhibit an indication of their presence in the observations taken daily at the Telegraphic Reporting Stations.

I now beg to submit the results of the comparison of these two independent records, and would state some general conclusions to which it has led me. I may say that the curves have afforded a most satisfactory corroboration of the Daily Weather Reports.

Of the curves themselves I think the barogram the most useful to us, as being that most *immediately* affected by changes in any portion of the surrounding atmosphere.

The thermogram cannot as yet be much used, in default of accurate information as to the diurnal range at each station, and also because it can only measure the temperature of the stratum of air in which the instrument is placed.

As to the anemogram the results are most remarkable. The effect of situation is apparently so great that while the wind at coast stations, irrespective of direction, frequently attained a velocity of 30 miles or upwards per hour, this never occurred at inland stations, except for five hours at Kew.

Accordingly I believe that any examination of the intensity of storms, based on the recorded velocities at a few isolated stations, would be deceptive.

I subjoin a statement of the number of hours at which high velocities were recorded at each observatory.

| | Miles | 20–25 | 25–30 | 30–35 | 35–40 | 40–45 | 45–50 | 50–55 | 55–60 |
|---|---|---|---|---|---|---|---|---|---|
| Aberdeen | | 36 | 29 | 16 | 7 | 5 | 2 | 3 | 1 |
| Glasgow | | 66 | 18 | 6 | 3 | — | — | — | — |
| Stonyhurst | | 8 | 3 | — | — | — | — | — | — |
| Kew | | 22 | 14 | 5 | — | — | — | — | — |
| Falmouth | | 48 | 43 | 22 | 18 | 15 | 2 | — | — |
| Valencia | | 43 | 21 | 10 | 12 | 5 | — | — | — |

I believe that frequently a storm glances upwards, leaving still air at the earth's surface, and only shows its passage over the station by driving scud, while the anemometer remains unaffected. Such a wind may be felt at the earth's surface at points very near the station. This effect is apparently produced very seriously by the proximity of trees to the instrument as well as by high and uneven land. We must, therefore, it seems to me, look to the sea coast for our estimate of wind force, having due consideration as to whether it be a lee or a weather shore.

This leads me to the Daily Journal, which seems capable of great improvement; in its present form it is all but worthless.

If the observatories used the Beaufort scale for weather it would bring their records into unison with the other observations sent to the office.

However, if the journal contained a short statement by the observer of the different forms of clouds, their position, and the direction of their motion, and of its rate as far as he could form an estimate of it, much valuable information would be furnished. We might then be able to see whether a southerly wind blowing at Falmouth was accompanied by clouds drifting from the south at Kew or Stonyhurst, and in case of the wind actually reaching these stations, we might learn how long the current had been prevalent in the upper strata of the air before it was felt at the earth's surface.

In fact I should venture to suggest that a log might be kept at each observatory, very similar to that kept at sea by our observers.

The only suggestion which I would venture to offer with reference to future discussion of weather would be that the *curves*, not the tabulations *only*, should be closely examined and compared with the Telegraphic Weather Reports, so as to make as complete a history of the weather as possible. It seems to me that the direction of the wind is almost of greater importance to the science of meteorology than its velocity, and this latter seems to be the only matter provided for in the method of storm anemograms.

I would subjoin, as an appendix, a brief account of the most remarkable peculiarities in the curves examined. Sept. 19–30, inclusive.

Sept. 20. About 1 a.m. a sudden decrease of pressure took place, which was greatest at Glasgow, extended to Aberdeen, and was felt slightly at Stonyhurst. While this was in progress the wind freshened to a hard gale at Aberdeen, and increased somewhat at Glasgow; both winds were easterly, and died down when pressure began to rise again.

Sept. 21. At 11 a.m. a sudden air from the south of east was felt at Kew, and caused the thermometer to rise 10°.

23rd. A sudden decrease of pressure took place in the early morning, 0·3 in. at Aberdeen, 0·15 at Glasgow. At Aberdeen the maximum rate of fall was ·029 from 3 to 4 a.m., and just after this the wind increased to N.N.W. 22 miles; this velocity ceased when the pressure became steadier. The wind at Glasgow was not affected.

During the day the pressure fell at Aberdeen till 1 p.m., briskly, then the rate became slower, and the wind backed from N.W. to N.E. and gradually increased, before midnight, to a gale (29 miles), dying at 2 a.m. Pressure remained steady during it. This wind did not appear elsewhere.

At Glasgow and Stonyhurst the wind freshened to a breeze from N.W. and W., respectively, from 1 to 5 p.m., while pressure was falling most rapidly.

Here then there seems to have been a sort of convergence of the wind from 2 to 5 p.m. at these three stations towards some point in the north of England.

24th. A decided minimum of pressure appeared at Cape Clear. At Falmouth pressure decreased 0·4 in., the rate becoming rapid at 10 p.m. At Kew the decrease set in at midnight, and began to be quick at 3 a.m. on the 25th.

The wind on this day was very remarkable.

At Valencia, there was a breeze N. to N.N.E., at 6 a.m. (25th) it increased to 23 miles, and at 8 a.m. to a hard gale 32 miles.

At Falmouth and Stonyhurst, the winds were both westerly in the morning. At 10 a.m. the W. wind freshened at Stonyhurst, while at Falmouth at 11 a.m. it veered to E., and was light, while pressure began to fall, but suddenly increased to a gale at 9 p.m., when pressure began to fall quickly.

At Glasgow, the wind veered to E., blowing a breeze at 4 p.m. with a sudden fall of temperature; it only lasted two hours and moderated till 4 a.m. 25th.

25th, 4 a.m., at Glasgow, Stonyhurst, and Kew, a sudden easterly current set in and grew to a gale at Glasgow by noon, at Stonyhurst it did not increase, at Kew it freshened till the velocity pencil broke down. The wind freshened from N. at Valencia at 6 a.m.

Here then apparently there is a movement of convergence towards some point in the S.W., beginning at Falmouth at 11 a.m. 24th, and after 18 hours appearing at the other stations.

This is not explained by the gradients, as far as I can see.

26th. During the day a remarkable change occurred, beginning at Falmouth.

| | | | | |
|---|---|---|---|---|
| Falmouth, | minimum reading | noon, | wind veered to | S.W. gale, backing to S.E. |
| Kew | „ | 4 p.m. | S.W. | dying. |
| Stonyhurst | „ | 10 p.m. | S.W. | very light. |
| Glasgow | „ | midnight, wind increased at E. | | |
| Aberdeen | „ | 4 a.m. (26th), wind not affected. | | |
| Valencia | „ | no barogram, wind veered to S.W. hard gale, 2 a.m. (26th), and backed again. | | |

Here the change set in at Falmouth, but the shift of wind was not propagated to Glasgow or Aberdeen.

It would be very interesting to know if there were any peculiarities in the motion of the clouds at these stations.

27th. The pressure at Aberdeen began to fall at 1 a.m., 12 hours later than at other stations, and the wind backed to S.E. and blew a hard gale (up to 42 miles), while pressure was falling.

At 1 p.m. at Falmouth, there was a sudden gust, 39 miles S.E., coincident with quickest hourly rate of fall.

A fresh oscillation then set in.

| | | | | |
|---|---|---|---|---|
| Falmouth, | minimum | 2 p.m., | maximum | midnight. |
| Kew | „ | 7 p.m. | „ | 8 a.m. 28th. |
| Stonyhurst | „ | 11 p.m. | „ | noon, 28th. |

Falmouth, hard S.E. gale, while pressure was falling; when the minimum reading was reached the wind veered to S.W. and blew hard for four hours, then moderated; after midnight, it backed again to S.E. and freshened, with another decrease of pressure.

Kew, wind did not shift, being S.W., and died after pressure began to rise.

Stonyhurst, at midnight, when pressure began to rise the wind veered to W.S.W. strong, for five hours.

27th. Valencia. Wind backed to S.E. at midnight and freshened at 8 a.m.

Glasgow. The wind shifted to a S.W. breeze at 8 a.m.

Aberdeen. The gale died down at 9 p.m.

Here, then, in the night a general motion from the south set in over all the western stations; it was not felt at Kew or Aberdeen. At the latter station the air ceased to move quickly from S.E. at 9 p.m., but the southerly wind, very faint, reached it early in the afternoon of the 28th.

28th. Falmouth. Wind veered at 1 p.m. to S.W. and freshened to 30 miles per hour for two hours, when pressure began to rise. At 7 p.m. pressure began to fall again, and the wind backed a little and blew a hard gale all night from S., pressure falling quickly.

Kew. Blew a fresh S.S.W. breeze with a falling barometer, and then at 5 a.m. 29th freshened for two hours just when barometer was at minimum.

Valencia. S.E. gale all day ; veered to S.W. 7 a.m. 29th.

Glasgow. At midnight increased to fresh breeze from E., and at 8 a.m. (29th) got to the south of E. and lulled.

Aberdeen. Wind showed southing 7 a.m. (29th), and increased.

Stonyhurst. Wind became E.S.E. 10 p.m., increased at 4 a.m. (29th), and again considerably at 8 a.m.

Here then is another nearly simultaneous southerly movement in the north and west.

29th. At Falmouth, Kew, Stonyhurst, and Valencia the S.W. gale blew all day long, and moderated about 6 p.m., when the pressure reached its maximum at Falmouth, at Kew maximum 8 p.m., and at Stonyhurst 11 p.m.

Pressure then fell at Kew and Falmouth, reaching minimum at Falmouth 5 a.m., Kew 8 a.m. The wind freshened considerably at both stations at the hour of the turn of pressure at Falmouth. Here then some changes in pressure at Falmouth were accompanied by changes of wind there and at Kew, while the wind at Kew did not appear to agree with the barometer at that station.

At Aberdeen and Glasgow the S.E. wind lulled at 11 a.m., when the minimum seems to have passed. The lull lasted for some hours. At 10 p.m. a N.N.E. wind appeared at Aberdeen and freshened to a gale at 4 a.m. (30th).

At Glasgow the N.E. wind appeared at 9 a.m. (30th), a light gale.

At Stonyhurst at 10 a.m.

At Valencia, 1 a.m. (30th), wind veered to W. by N. and freshened, drawing to a stiff breeze from N.W.; at 8 p.m. the N.E. wind appeared there.

At Kew. The N.E. wind reached Kew after a lull, at 3 a.m. on the 1st October. Here there was a sudden jump in the barometer at 7 a.m., not seen elsewhere. There is a gap in the Falmouth barogram on the morning of October 1.

The pressure began to rise at Stonyhurst rapidly at 3 p.m., much later than at other stations.

Here apparently we can trace the progress of a N.E. wind to leeward.

The Secretary presented the following supplementary report regarding a method of co-ordinating the records of the self-recording instruments :—

HAVING been requested by this Committee to report to them as to what I considered the best method of co-ordinating the records of the different observatories for the purpose of indicating the progress of weather (see Minutes, June 1, 1868, page 41), I submitted, on June 29, a preliminary report on this subject, chiefly with the view of eliciting the opinions of the various members of the Committee as to the proposed method of estimating numerically the violence of storms.

It may be desirable to make a few additional remarks on this subject, in order that the Committee may have complete information regarding the method which I venture to suggest. It would seem that the attempt to classify storms might naturally begin with the elements of violence and direction, and that by a method such as has been suggested, a preliminary classification, more or less complete as regards these elements, may be obtained without much labour. Let us suppose for the sake of illustration that the method of storm anemograms has been applied to all the anemograph results for 1868, and that we have found several examples of storms of type A, and several of type B, while at the same time we have several examples of complicated storms which have not repeated themselves up to the end of the year. Leaving aside these complicated storms until more observations are procured, let us in the meantime consider the storms which have repeated themselves, such as those of types A and B. It may perhaps be found that all the storms of type A have nearly the same behaviour, attacking the various stations in nearly the same order of time and with the same relative violence. If this is even approximately the case we have already arrived at a generalisation of some value.

The next step would be to examine the other meteorological elements (barometer and thermometers) for these storms, for which we have already obtained a number of repetitions in the preliminary method of classification which has been attempted. Without at present entering further into the subject, permit me to remark its connection with the question as to how thoroughly we can determine the actual meteorological accompaniments of a British storm from the information the Meteorological Committee at present possess.

I am, &c.,
B. STEWART.

Mr. Scott submitted the following correspondence relative to the instruments at the Edinburgh Training School. Minutes, 1867, p. 97.

SIR, Meteorological Office, December 15, 1868.

I AM instructed by the Committee to request that the Board of Trade will have the kindness to inform them whether they deem it advisable that the Church of Scotland Training School at Edinburgh should be permitted to retain a set of meteorological instruments for purposes of education.

The instruments in question were originally lent to that institution by Admiral Fitzroy, and as the Committee find that they have not been used for the purpose of giving instruction to seamen in any way, they wish to know whether the Board of Trade would approve of instruments being retained in any case for use in a school like the training school mentioned.

The practice of the Committee is to issue no instruments for educational purposes except to navigation schools.

I am, &c.,
(Signed) ROBERT H. SCOTT,
Director.

Thomas Gray, Esq.,
Assistant Secretary, Board of Trade.

M. 11,212.

SIR, Board of Trade, Whitehall, December 24, 1868.

I AM directed by the Board of Trade to acknowledge the receipt of your letter of the 15th inst., requesting to be informed whether they deem it advisable that the Church of Scotland Training School at Edinburgh should be permitted to retain a set of meteorological instruments for purposes of education.

In reply I am to state that the Board of Trade agree with the Meteorological Committee in their policy of not issuing instruments for educational purposes excepting to navigation schools, but they are disposed to think that if the instruments supplied to the Church of Scotland Training School are intended to be used hereafter for educational purposes, or have been and are to be used for observations, it would not under the special circumstances of the case be advisable to recall them.

I am, &c.,

R. H. Scott, Esq., Meteorological Office. (Signed) THOS. GRAY.

Resolved—That the Training School be permitted to have a set of instruments; BT instruments to be sent in lieu of those on Admiralty account now in their hands.

Mr. Scott submitted a correspondence with the Rev. A. Beverley, and the following draft of a letter respecting the instruments at the Grammar School, Aberdeen, which was approved:—

SIR,

I AM instructed by the Committee of the Meteorological Office to request that you will have the goodness to cause the set of meteorological instruments (list enclosed) which were lent to the Rector of the Aberdeen Grammar School in 1864 to be returned to this office.

They are almost exclusively Admiralty instruments, and accordingly are required for issue to the navy.

At the same time I am to say that if a set of instruments is required at the Grammar School for the purposes of instruction of pupils intended for a seafaring life, the Committee would be prepared to entertain an application to have the present set replaced by others.

As soon as I receive your reply I shall have a case forwarded to Aberdeen.

I am, &c.,

John Angus, Esq.,
Town Clerk, Aberdeen.

Read the following report:—

R. H. Scott, Esq., M.A., Director of the Meteorological Office.

SIR, Meteorological Office, 2, Parliament Street, London, S.W., January 2, 1869.

I HAVE now finished examining the back numbers of logs in this office, from No. 1 to No. 379, and consider that the following are valueless:—

No. 112. Consisting of nine log books badly kept with no longitudes entered.

No. 194. Showing no barometric changes, which leads me to doubt the other entries.

Nos. 224 to 226. Not sufficiently correct for use in this office. They are abstract logs.

No. 322 & A. No range of the barometer, only one entry of the wind, without its force.

A large number of the entry Nos. are not logs, and many had been borrowed from the Admiralty for a special purpose and returned, which accounts for the few which are condemned compared with the list lately submitted. Will you communicate these facts to the Committee?

I am, &c.,
HENRY TOYNBEE,
Marine Superintendent.

Approved.

Read the following report:—

R. Scott, Esq., M.A., Director of the Meteorological Office.

SIR, Meteorological Office, 2, Parliament Street, London, S.W., Dec. 22, 1868.

DURING Capt. Inglis's visit to town last week I mentioned to him the Committee's desire to get sea temperatures from high northern latitudes; he at once suggested that we should apply to Allan Brothers, who have a line of steamers to Canada, saying that they generally sail out north of Ireland, and in the summer months go through the Straits of Belle Isle. I may add that having nearly finished the discussion of the log of one of Cunard's steamers, I think the barometer, winds, &c., of a more northern route would be very valuable by helping us to understand the normal circulation of the air in the north temperate zone. Will you ascertain from the Committee if they wish me to communicate with Messrs. Allan Brothers & Co.? Enclosed is one of their circulars.

I remain, &c.,
HENRY TOYNBEE,
Marine Superintendent.

Approved. Capt. Toynbee to communicate with Messrs. Allan Brothers & Co.

Read letter from Rev. C. Clouston, requesting that the anemometer to be sent to him should be made extra strong.

Referred to Mr. Stewart, who was also instructed to ascertain the probable expense of an instrument such as Mr. Clouston requires.

Submitted an application from Capt. Creasy, R.N., Inspecting Commander of Coast Guard at Cromer, for the daily issue of a copy of the weather report to that place.—Granted.

Read a letter from the Board of Fisheries, Edinburgh, respecting application for the loan of fishery barometers to certain stations to the following effect:—

Auchmithie. Repair of existing barometer recommended.—Approved.

Oban. Claim not considered satisfactory.—Application refused.

Downies and Drumore. No definite recommendations made by Board of Fisheries for grounds stated by them.

The application from Drumore was acceded to conditionally on the efforts now being made to induce the landlord of the place to purchase one not being successful.

No action was taken as to Downies at present.

Mr. Scott submitted the following report as to the proposed lithography of the curves for a fortnight. Minutes, 1867, p. 89.

Meteorological Office, January 11, 1869.

HAVING examined the various curves and tabulations received from the outlying observatories, for the period Nov. 17th to 30th, 1868, I find the following are the only *apparent* defects for the time:—

BAROGRAMS.—*Aberdeen.* 21st at 9 p.m. to 22nd 10 a.m., definition very bad, cannot be traced.

*Armagh and Valencia* barograms not yet received.

THERMOGRAMS.—*Aberdeen.* 21st, wet-bulb not readable, for 1 hour only.

*Falmouth.* Nov. 21st 4.40 p.m. to 23rd 2 p.m., dry-bulb curve too indistinct to trace. 26th, 4 p.m. Slight defect from shifting of cylinder. The Falmouth curves are rather faint during this period.

*Valencia.* Thermograms not received yet.

* ANEMOGRAMS.—*Armagh* and *Valencia* records not received.

If the missing records are sent in the period would make a good one for tracing and lithographing for a specimen, as *very considerable* atmospherical changes occurred at the time.

ROBERT H. SCOTT.

Approved.—The work was ordered to be commenced.

Read an application from the Literary and Philosophical Society, Sheffield, for the loan of a model of the wind semaphore, for exhibition at their rooms on the 11th February, they paying expense of carriage to and from Sheffield.—Granted.

Mr. Scott stated that he had been invited by the Secretary of the Royal Institution to deliver a lecture there at the end of April, on the work of the office.—Permission granted.

He stated further that he had been invited by the Secretary of the United Service Institution to deliver a lecture there at about the same period.

Permission granted, but the lecture to be delivered subsequent to that at the Royal Institution.

Mr. Scott stated that he was in correspondence with the Board of Trade and with Mr. J. T. Woodhouse, C.E., with the view of reviving the question of the proposed issue of Telegraphic Weather Intelligence to collieries. Minutes, 1868, p. 1.—Approved.

Mr. Scott submitted the following statement, pursuant to resolutions of Committee dated July 20, 1868:—

ACCOUNTS PAID, AND LIABILITIES.

| | Paid. | Estimated Liabilities. |
|---|---|---|
| | £ s. d. | £ s. d. |
| Salaries - - - - | 1,965 4 3 | |
| Instruments, mercantile marine - | 79 3 6 | 26 8 6 |
| „ Admiralty - - | 165 13 7 | 124 0 0 |
| Agencies at ports - - | 36 17 11 | 8 0 3 |
| Travelling - - - | 134 17 11 | — |
| Telegraphy - - - | 1,405 16 1 | 366 9 0 |
| Observatories, current expenses - | 1,388 3 3 | 89 5 8 |
| „ outfit - - | 445 1 1 | 112 13 11 |
| Special printing - - | 42 8 2 | — |
| Contingencies - - - | 177 7 0 | 48 13 1 |
| Total - - - | 5,840 12 9 | 775 10 5 |

Grand total - - £6,616 3 2.

*To December* 31, 1868.

ROBERT H. SCOTT, Director.

* The Falmouth curves fail entirely on Nov. 8th to 9th, and 14th to 15th.

Mr. Scott stated that on the 30th December he had drawn, on the signature of General Sabine, the sum of 1,500*l.* from the deposit account, and lodged it in the Bank of England to the current account of the Committee.

Read a letter from W. P. Dymond, Esq., Honorary Secretary to the Royal Cornwall Polytechnic Society, to Mr. Stewart, suggesting that the allowance to the Falmouth observatory should be increased by the amount of (say) 50*l.* per annum, in order that the Polytechnic Society might be enabled to engage an assistant who should be properly trained, so that the risk of a gap in the observations may be avoided, and the observer be assisted in his duties.

Resolved—That the subject be postponed until the returns from the Falmouth observatory are more satisfactory.

Resolved—That the Rev. Dr. Robinson be requested to send to the Meteorological Committee the traces of his anemograph, in order that these may be preserved along with the tabulations at the central office.

The Committee then adjourned.

# METEOROLOGICAL COMMITTEE.

13, *Ashley Place, Monday, January* 25, 1869.

PRESENT :

General Sabine in the Chair.

| | |
|---|---|
| Mr. Gassiot. | Dr. W. A. Miller. |
| Captain Richards. | Mr. De La Rue. |

The Director and the Secretary to the Committee were in attendance.

The minutes of the last meeting were read and confirmed.

Mr. Scott reported that he had forwarded to Aberdeen the letter which was submitted to the Committee at their last meeting, and that since that time Mr. Angus, the town clerk of Aberdeen, had waited on him and intimated that the town council would probably apply for a set of instruments in place of those recalled.

He also stated that he had received a letter from the Literary and Philosophical Society, Sheffield, stating that they found it would not be possible to avail themselves of the permission of the Committee to borrow the semaphore model, owing to its great size and the consequent expense of transit.

Read—Letter from Mr. J. T. Woodhouse, stating that he considered that the issue of telegraphic weather intelligence to collieries would be a useful measure.

Mr. Scott stated that he understood that the Board of Trade were not prepared to act in the matter without further information.

Resolved—That Mr. Scott be authorized to write to the several Colliery Inspectors, to ask their opinions on the subject.

Submitted—An application from the Board of Fisheries, Edinburgh, for the loan of a fishery barometer to Portpatrick.—Granted.

Submitted—An application from the harbour master of Port Dinorwic, North Wales, for the issue of a lithographed copy of the daily weather report.—Granted.

Submitted—An application from the manager of the "Echo" for a MS. copy of the daily weather report.—Granted.

Mr. Scott stated that as the period had elapsed at which the records for the past year from the various self-registering observatories should be sent in to the office, he submitted a return of all that had been received since July 1, 1867.

RETURN of the SELF-REGISTERING RECORDS and their Tabulations, received at the Meteorological Office, for the Year 1868.

| 1868. | Names of Observatories and Documents received. | | | | | | |
|---|---|---|---|---|---|---|---|
| | Aberdeen. | Glasgow. | Armagh. | Valencia. | Stonyhurst. | Kew. | Falmouth. |
| Barograms | April—Decr. | Jany.—Decr. | — | — | Jany.—Decr. | Jany.—Decr. | May—Decr. |
| Thermograms | April—Decr. | Jany.—Decr. | May—Decr. (except July) | — | Jany.—Decr. | Jany.—Decr. | May—Decr. (except July) |
| Anemograms | April—Decr. | Jany.—Decr. | — | Augt.—Novr. | Jany.—Decr. | Jany.—Decr. | March—Decr. |
| Rain & Weather | April—Decr. | Jany.—Decr. | June—Decr. | Augt.—Novr. | Jany.—Decr. | Jany.—Decr. | March—Decr. |

Also received, Kew barograph curves, July—December 1867, excepting following days : 1st—11th July, 15th—25th July, 30th August, and 3d to 31st December (old series).

ROBERT H. SCOTT.

Mr. Scott stated that he had been informed by Dr. Robinson (see Minutes, 1868, p. 97) that there was no immediate prospect of his Manual of Anemometry being ready for printing.

He submitted the following sketch of a mode of tabulation which Dr. Robinson had forwarded to him in the course of last summer, which was ordered to be printed.

### Co-ordination of the Anemograph Results.

The process described by Dr. Balfour Stewart gives for each hour the space traversed by the wind during the 60m. of which that hour's number is the centre, and the mean direction during that time. The spaces are given in statute miles; the directions in points, reckoning from the north as zero, round by the east. To obtain from these data any information which may lead to general views, it is necessary to combine them so as to bring out any laws by which they are connected.

At first sight nothing seems more hopeless, for the seemingly capricious changes of the wind have become a proverb. But it is a certain truth that whenever there exists in any series of phenomena a definite element, even though at first imperceptible and overshadowed by irregular fluctuations, yet, if enough of observations be given, it can assuredly be disentangled from the seeming chaos. Such definite elements may be expected here, for all or nearly all the causes of wind depend on variations of temperature; these again vary with the hour of the day and the season of the year. The rule of grouping should therefore be by hours in the first instance, and of such a kind that any number of each can be combined without limit and without repeating previous work for days or years.

No plan fulfils this object so well as the method of co-ordinates. Let V be the hourly velocity of the wind; D its angle with the meridian measured from the north; the northern component $N = V \cos D$; the eastern one $E = V \sin D$. Suppose we want the mean V and D for any period, say a day. Add all the Ns for the time, remembering that N is *negative* from east through south to west; and E is *negative* from south through west to north. Let these sums, divided by 24, be N′ and E′ then

$$\text{Tan } D' = \frac{E'}{N'} \text{ and } V' = \frac{N'}{\cos D'} = \frac{E'}{\sin D'} = \sqrt{N'^2 + E'^2}$$

If E′ and N′ are both +, D′ is in the first quadrant; if both are —, it is in the third. If E′ be + and N′ be —, it is in the second; if E′ be — and N′ +, in the fourth. D′ must then be turned into points by dividing it by 11° 15′. But in this work it might be better to leave it in degrees.

This computation of the co-ordinates by the tables is too tedious, and I prefer obtaining them mechanically by the following instrument:

Fig. 1.

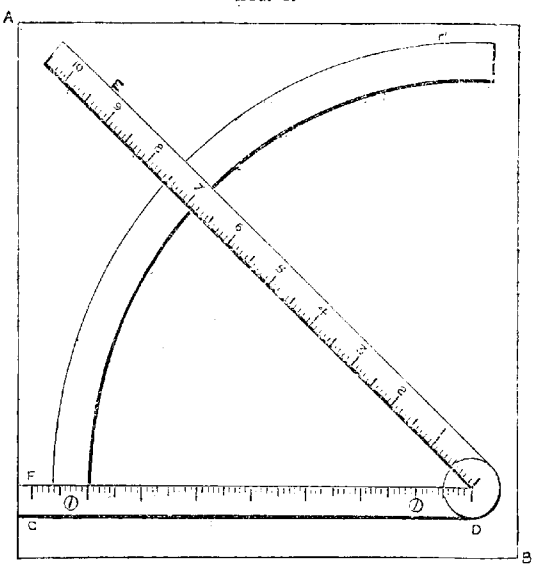


Fig. 2.

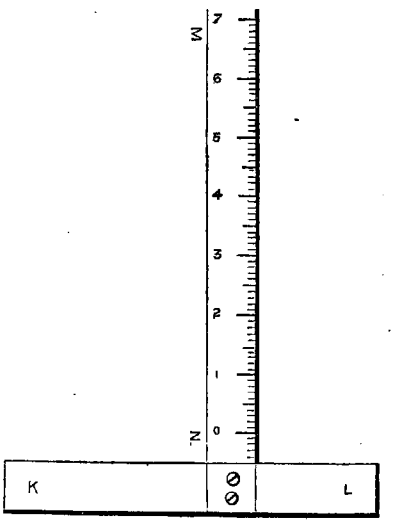


Fig. 1. A B is a piece of mahogany to which is screwed C D, the leg of a piece like the ordinary sector rule. The other leg E D is moveable round the centre D. This centre must be the centre of the arch F H. The legs may be 10 inches, divided at their inner edges into 20ths, each 10 numbered from the centre. The arch should be divided at its inner edge into points and tenths up to 8, beginning from the graduated edge of F D. This arch may be printed on paper, which can be pasted on the mahogany and last for years. Outside the first numeration should be three others, enabling the operator to set E D to a D in every quadrant without any computation.

N and E are got by the square (Fig. 2). Its base K L, three or four inches long, is as thick as C D, so that when applied to the lower edge of it the upright M N may be flat on it and E D. It is also graduated like them, but its graduation must begin at that of C D. It is thus used. Let E D be the direction; apply the square to C D, slide it along till the graduated edge of M N cuts the graduated of E D at the unit and decimal of V. Then read off E on M N, N on F D. For V above 20 the co-ordinates must be taken in parts. In my experience I have found this process gives them correct to the second decimal, but it requires exact concentricity of the arch, and that the square be true.

If the number of years to be reduced be sufficiently numerous, it may be advisable in the first instance to take each hour of the 24 apart for the whole time, but it is not probable that less than 10 or 12 years will show much correspondence in the hour numbers for successive days. There will be much

greater chance of success by grouping this hourly result for 10, 15, or 20 successive days, for during this time the sun's declination will not change enough to make any notable variation in the hourly law.

Secondly, the mean hourly results thus obtained should be combined in means of two or three, which will give the diurnal changes yet more distinctly.

Thirdly, from these should be derived the mean velocity and direction for the hours when the sun is above or below the horizon.

Fourthly, these day and night means should be meaned for the months when the sun is above the equator and those below it.

Lastly, the day and night means should be given for the whole year, and the mean of both. This last mean V multiplied by the number of hours in the year will give the absolute motion of the air at the place of observation in the annual mean direction.

This system of examination should be continuous, but a similar one should perhaps occasionally be made with reference to any remarkable barometric change. In ordinary cases, however, the comparison of V and D directly may be sufficient.

(Signed) T. R. Robinson.

General Sabine submitted to the Committee the sketch of an arrangement which he had proposed for the reduction of the observations taken at the various observatories of the Meteorological Committee, which was ordered to be circulated amongst the members.

Mr. Scott stated that he would require additional assistance in the office to undertake such reductions, and that for the estimate for 1869–70, printed in the Minutes, 1868, p. 93, he had made provision for an increase of the staff with a view to meeting this difficulty.

Resolved—That Mr. Scott be authorized to engage Mr. Jeffery for this work, at the salary of 3*l.* per week.

The following sketch of the duties of the Committee and officers, prepared by Mr. Gassiot, was approved and adopted by the Committee:—

## Meteorological Committee.

The Committee consist of Fellows of the Royal Society, appointed by the Council; their services are gratuitous, but they have power to appoint a salaried Secretary to afford them scientific as well as usual clerical assistance.

The Committee meet periodically at the Central Office, or at any other place they may from time to time appoint. The Director and Secretary each attend, the latter keeping the minutes.

At these meetings reports from the Director, and from the Secretary as Director of the Central Observatory, will be presented and discussed.

The instructions of the Committee to its officers, arising out of the reports or otherwise, will be by resolutions recorded and entered on the minutes by the Secretary.

The Committee have the appointment and power of dismissal of all officials connected with the Meteorological Office; they fix the duties and amount of all salaries or remuneration to be paid to each official.

The names of all persons receiving salaries or remuneration for services performed, with the total amount paid to each during the current year, to appear in the annual financial statement, forming part of the annual report presented to the Board of Trade.

All payments, except petty disbursements which appear in the Director's Petty Cash accounts, to be made by cheques to order, signed by one member of the Committee, and countersigned by the Director. The particulars of such cheques to be entered on the minutes.

## Director of the Office.

The Director of the Meteorological Office has the entire superintendence of the office, subject to the control and directions of the Committee.

In the branch of Ocean Meteorology he has the assistance of a competent officer of the mercantile marine, whose experience will enable him to carry on this department on the plan selected by the Committee; this officer to be at all times at liberty to make special reports to the Committee, through the Director (see Minutes, 1867, page 4), which reports will be considered and dealt with by the Committee.

The Director has the general superintendence of, and is responsible for, the entire system of telegraphic weather intelligence daily issued from the office.

He receives monthly from the Central Observatory the returns furnished by the several observatories, after they have been examined and arranged at the Central Observatory; he takes charge of and retains all such returns, and furnishes copies to such person or persons as the Committee may name.

He is responsible for the discussion of these returns, according to the plan to be hereafter decided on by the Committee.

In the foregoing work he will have the assistance of a competent staff of clerks.

He shall at any time visit such telegraphic stations and Observatories as the Committee may direct.

He receives all monies from the Treasury, or other sources, on account of the Meteorological Office, lodging them to the credit of the Committee at such bank or banks as they may direct.

He is responsible to the Committee for all the financial business of the office, countersigning all cheques as previously named, and also countersigning all accounts, as vouching for their correctness, before they are presented to the Committee for payment.

He shall prepare a draft of that portion of the annual report which refers to the work carried on under his superintendence, and shall submit the same to the Committee.

He will edit and be responsible for all publications of the office, unless especially ordered otherwise by the Committee.

### Secretary to the Committee and Director of Central Observatory.

The Secretary to the Committee shall attend all meetings of the Committee, keeping the minutes, and conduct all correspondence with the outlying observatories, as well as such other correspondence as the Committee may direct.

He shall be responsible for the printing of the minutes, but not for the publications of the office, unless by special resolutions of the Committee.

As the Director of the Central Observatory he has the general superintendence of the self-recording observations of the

Barometer,
Thermometers,
Anemometer,

at the Central (Kew) and the following outlying observatories:—

| | |
|---|---|
| Falmouth, | Stonyhurst, |
| Glasgow, | Aberdeen, |
| Armagh, | Valencia. |

The general duties to be performed at each observatory have been fully discussed in the report of the Kew Committee (minutes, 1868, p. 100), and it becomes his special duty to see that these are carried out.

The self-recorded observations made at the several observatories are to be forwarded by him monthly, fit for discussion, to the Director of the Meteorological Office, such observations to be preserved under the Director's charge at the office.

The Secretary will, when directed by the Committee, visit the several outlying observatories, or any of the meteorological stations; he will there examine the action of the self-recording instruments, &c., in order to ascertain whether their performances are in accordance with the general plan devised and arranged by the Committee.

He will examine and vouch for the correctness of all accounts of expenditure incurred by the several observatories, the payments of which will be made through the Director either to him or to the superintendent of the particular observatory, as he may desire, on his presenting the vouchers to the Committee with his *indent*, and no such payment shall be made except on an indent signed by him.

He shall prepare a draft of that portion of the annual report which refers to the working of the several observatories, including the central, and shall submit the same for the consideration of the Committee.

The Secretary stated that from inquiries which he had made he considered that sufficient strength could be secured for the Orkney anemometer without any material increase in its cost.

He also stated that he had communicated to the Secretary of the Royal Cornwall Polytechnic Society the resolution passed at last meeting of the Committee, and had also informed Dr. Robinson that the Committee wished to have his anemograph curves, to which request he had acceded.

Read—A letter from Mr. Henry Edwards, Milford, South Wales, offering to the Committee monthly records from a self-registering Robinson's anemometer.

Read—A letter from Mr. J. H. Batten, honorary secretary to the Royal Geological Society of Cornwall, stating that it was in contemplation to establish an anemometer at Penzance, and asking for information as to its cost, &c.

Resolved—That Mr. Scott be requested to place himself in communication with Mr. Edwards and Mr. Batten.

Resolved—That the sum of 80*l.* (in addition to the 120*l.* already granted) be placed at the disposal of the Kew Committee for the year 1869, for additional clerical assistance, to be given in revising the records of the various observatories, in accordance with the scheme adopted by the Meteorological Committee.

Resolved—That the sum of 25*l.* be placed at the disposal of the Kew Committee, for the remeasurement, by the method of subsidiary tabulations, of those barograms for 1868 which had been sent to Kew previous to the adoption of this method of remeasurement at the outlying observatories.

The following cheques were drawn:—

| | £ | s. | d. |
|---|---|---|---|
| Salaries for January: | | | |
| R. H. Scott | 66 | 13 | 4 |
| H. Toynbee | 33 | 6 | 8 |
| B. Stewart | 33 | 6 | 8 |
| W. Salmon | 17 | 10 | 0 |
| J. S. Harding, junior | 13 | 6 | 8 |
| R. Strachan | *15 | 16 | 8 |
| F. Gaster | 9 | 3 | 4 |
| C. Harding | 8 | 6 | 8 |
| R. H. Curtis | 6 | 19 | 2 |
| J. S. Harding, senior | †6 | 0 | 0 |
| F. Steventon | 6 | 13 | 4 |
| Instruments: | | | |
| Negretti and Zambra | 9 | 4 | 6 |
| Elliott Brothers £1 3 0 | | | |
| Ditto (A. Instruments) 7 0 0 | | | |
| | 8 | 3 | 0 |
| Agencies at Ports: | | | |
| H. Smart, Liverpool | 7 | 18 | 9 |
| Telegraphy: | | | |
| Electric Telegraph Company, Novr. £56 15 6 | | | |
| Ditto Special Charges, October 21 10 8 | | | |
| Ditto ditto November 15 2 10 | | | |
| Ditto ditto December 24 7 1 | | | |
| | 117 | 16 | 1 |
| Magnetic Telegraph Company, December | 71 | 16 | 6 |
| Submarine ditto ditto | 42 | 11 | 6 |
| B. Edgington, Signal Drums | 7 | 3 | 8 |
| J. Bolam, Alterations at Leith to Telegraph Station | 6 | 16 | 6 |
| Carried forward | 488 | 13 | 0 |

* Including extra allowance for care of Instruments.
† For four weeks.

| | £ | s. | d. |
|---|---|---|---|
| Brought forward - - - | 488 | 13 | 0 |
| Observatories: | | | |
| P. Adie, Tabulating Instruments - - | 20 | 12 | 4 |
| R. Beckley, for Kew Committee - - | 4 | 9 | 9 |
| J. Driscoll, Half-year's Rent at Valencia - | 25 | 0 | 0 |
| T. Kerr, Salary for January - - - | 20 | 16 | 8 |
| Ditto, on account for current Expenses - - | 39 | 2 | 11 |
| T. R. Robinson, Armagh - - - | 6 | 1 | 8 |
| Special Printing: | | | |
| J. and C. Walker, Charts - - - | 6 | 10 | 0 |
| Contingencies: | | | |
| Byfield, Stanford, & Co. "Shipping Gazette," &c. | 4 | 3 | 10 |
| R. H. Scott, extra work of Staff - - | 35 | 8 | 9 |
| Office, Petty Expenses: | | | |
| J. S. Harding, junior, on account - - | 15 | 0 | 0 |
| Total - | £665 | 18 | 11 |

The Committee then adjourned.

# METEOROLOGICAL COMMITTEE.

13, *Ashley Place, Monday, February* 1, 1869.

PRESENT:

General Sabine in the Chair.

| | |
|---|---|
| Capt. Richards. | Dr. W. A. Miller. |
| Mr. Spottiswoode. | Mr. Gassiot. |
| Mr. Galton. | |

The Director and the Secretary to the Committee were in attendance.

The minutes of the last meeting were read and confirmed.

Mr. Scott submitted the following letter, which he had sent to the several Colliery Inspectors, as sanctioned at last meeting.

SIR, Meteorological Office, January 28, 1869.

THE question of the issue of telegraphic intelligence of atmospherical disturbances to collieries has been under the consideration of the Committee of this office for more than a year past.

I am now instructed by them to request that you will have the kindness to give them the benefit of your opinion as to the probable utility of such a system, and also as to how, if found advisable, it might be carried out, at as moderate a cost as possible.

I may say that this office would be unwilling to incur a serious expense, unless the benefit to result therefrom were very great.

I have, &c.,

H.M. Inspector of Coal Mines. ROBERT H. SCOTT, Director.

Mr. Scott reported that he had engaged Mr. Jeffery, at the salary named by the Committee, p. 11. His appointment to take date from the 25th January.

Read the following letter:

Meteorological Office, 2, Parliament Street, London, S.W.,

SIR, January 30, 1869.

WILL you bring the accompanying letter to the notice of the Committee, as I could not accept the offer therein proposed without their sanction.

Considering that the duties of Assessor for the United Kingdom were performed by two persons, if the London work is to be divided amongst all the younger brethren of the Trinity House, each man's share must be something very small, and I should like to take my turn.

I am, &c.,

R. H. Scott, Esq., M.A., HENRY TOYNBEE.
Director of the Meteorological Office.

Read herewith—A letter from the Secretary to the Trinity House, asking if Capt. Toynbee could act as an Assessor in the County Courts.

Resolved—That Capt. Toynbee be permitted to accept the position in question.

Read—An application from Mr. C. Meldrum requesting permission to have extracts made from the registers in the office, relating to the Indian Ocean, for the month of January 1861, at his own expense, according to the rules laid down by the Committee.—Granted.

Mr. Scott stated that as new lithographed drawings of the various types of clouds were required for insertion in the Foreign Lighthouse Registers (Minutes, 1868, p. 47), Capt. Toynbee had kindly undertaken to have good drawings made, which were now ready to be lithographed.—Approved.

Read—An application from the Collector of Customs at Hayle for the supply of a copy of the Daily Weather Report.—Granted.

Mr. Scott submitted a list of Admiralty instruments which he had been unable to trace hitherto.

He was authorized to write off the following instruments:—

(1.) Two barometers, Adie 219, 240, supplied to "Black Sea Fleet," 18th August 1855.

(2.) Four hydrometers, Casella 819 to 822, supplied to H.M.S. Havannah, for distribution to Pacific Squadron, 10th October 1855. Numerous other instruments issued to same ship were accounted for.

(3.) Aneroid 14,503, and a pair of registering thermometers, supplied to Dr. Andrew Sinclair, R.N., 22nd January 1858, who has been dead some years.

(4.) One barometer, Negretti 308; six thermometers, Negretti 841 to 846; four hydrometers, Negretti 33 to 36; supplied to Earl Gifford, June 30th, 1858, for his yacht "Fair Rosamond." He has been dead many years.

(5.) Aneroid, Negretti II., and two thermometers, Negretti 123, 124, supplied to Admiral Washington for an expedition into Syria, 17th August 1860.

(6.) The following standing on the books to Admiral FitzRoy:—

Aneroid, B.T. 7, date 7th July 1860.
„ A 2, „ 14th May 1862.
„ „ 7, „ 21st Sept. 1861.
„ „ 10, „ 30th April 1863.
„ 19,685, „ 1st Sept. 1863.

Minimum thermometer, Casella 327, 7th March 1863; and four hydrometers, Casella 491 to 494, 2nd June 1862.

The Committee then adjourned.

# METEOROLOGICAL COMMITTEE.

2, *Parliament Street, Monday, February* 15, 1869.

PRESENT:

Dr. W. A. Miller in the Chair.

Mr. Galton. | Captain Richards.

The Director and the Secretary to the Committee were in attendance.

The Minutes of the last meeting were read and confirmed.

Mr. Scott reported that the Board of Trade had left the house, No. 2, Parliament Street, and that accordingly it became necessary for the Committee to make arrangements for clearing the office, &c., and for the daily attendance of some one to receive all persons coming to the office.

With reference to the former matter, he proposed that an allowance of 15*s.* per week should be made to Mrs. Haliday, who is now resident in the house, for keeping the rooms clean which are required by this office. This to commence from the date on which her allowance from the Board of Trade ceases.

In addition he recommended that she be supplied with fire and light, and with brushes and other articles required for cleaning as soon as same are required.

With reference to the latter, he proposed that Mr. J. S. Harding, sen., be engaged to attend, at a salary of 1*l.* 18*s.* 6*d.* per week, that his hours be from 9.30 a.m. till 5 p.m., and that he keep the contingent account for petty expenses. His spare time to be occupied in rendering assistance in copying letters, &c.—Agreed to.

Mr. Scott further submitted the following scheme of the duties of the several clerks, and of the Commissionaire, which was agreed to:—

W. Salmon, R.N.—Ocean Meteorology. Reduction of logs.
J. S. Harding, jun.—Correspondence and accounts.
R. Strachan.—Care of instruments, and correspondence therewith connected.
S. Jeffery.—Discussion of returns from observatories.
F. Gaster.—Preparation of weather report, and investigations of daily weather by returns from observatories.
C. Harding.—Ocean Meteorology. Reduction of logs.
R. H. Curtis.— Do. Do.
F. Steventon.—Preparation of weather report, and assistance to Mr. Gaster.
Vacant.—Assistance to Mr. J. S. Harding, jun., in registry of documents, and occasional copying.
J. S. Harding, sen.—Attendance at extra hours for receipt of telegrams. Care of stores, &c. Management of contingent expenses.
Commissionaire, Messenger.—Assistance in instrument room when required.

All junior clerks to give assistance, in turn, in the preparation of the weather report, when required.

Mr. Scott stated that a portion of the data for the Indian Ocean (see Minutes, 1868, p. 91) was now ready to be sent to the Admiralty, and he was directed to forward it to the Hydrographic Office, with a note requesting that an acknowledgment of the source whence the information had been derived should be inserted on the charts in which it was used.

Submitted—An application from Mr. Kerr, requesting permission to expend 3*l.* in repairing a sea wall damaged by a late storm, and 3*l.* 5*s.* on a desk for the new barograph tabulating instrument.—Approved.

Read—The following extract of a letter from Dr. Robinson to the Secretary regarding his anemograph papers :—

" Mr. Grubb proposes to paste two sheets together by a cement of caoutchouc which is now used by photographers, then to print each side *dry* by surface printing. He sent me some specimens which have been lying 10 days on the table of the instrument and have quite resisted damp, when the sheets actually in use were troublesome. A new plate (with the lines in relief) would be requisite, and would cost about 3*l*. The cemented paper would add expense, but surface printing is so much cheaper than copper-plate that he thinks the cost of the sheets (the plate being provided) would not exceed the present."

Resolved—That Dr. Robinson be requested to proceed with the above arrangement.

The Committee then adjourned.

# METEOROLOGICAL COMMITTEE.

13, *Ashley Place, Monday, March* 1, 1869.

PRESENT:

General Sabine in the Chair.

Mr. Gassiot. | Mr. Galton.
Captain Richards. | Dr. W. A. Miller.
Mr. Spottiswoode.

The Director and the Secretary to the Committee were in attendance.

The minutes of the last meeting were read and confirmed.

Read—The following letter:—

1435A.

SIR, Office of Works, &c., 24th February 1869.

REFERRING to the occupation by the Meteorological Department of certain rooms at Nos. 1 and 2 Parliament Street, I am directed by the First Commissioner of Her Majesty's Works, &c., to inform you that this Board require to resume, as early as practicable, possession of those rooms and of the furniture in them, the property of the Government, and I am to inquire when it will be convenient to the Meteorological Department to vacate the premises.

I am, &c.
(Signed) GEORGE RUSSELL,
Secretary.

"R. H. Scott, Esq., Director Meteorological Office.

Mr. Scott stated that he had sent the following reply, which was approved:—

SIR, Meteorological Office, 25 February 1869.

I HAVE to acknowledge the receipt of yours of the 24th instant (1,435A.) which shall be laid before the Committee at the next meeting.

At the same time I should be much obliged if you could let me know, for the information of the Committee, whether, in the event of their having to furnish an office, it would be possible for them to purchase from Her Majesty's Office of Works, at a valuation, any portion of the furniture, the property of that office, which is now used by the Meteorological Office, more especially certain presses, 15 in number, fitted some with pigeon-holes and others with drawers for the reception of charts, originally supplied to the Meteorological Department for special use.

I am, &c.
(Signed) R. H. SCOTT, Director.

George Russell, Esq.
Secretary Office of Works, &c.

The following draft letter to the Board of Trade on the subject was adopted:—

SIR,

I AM instructed by the Committee to forward a copy of a letter received on the 25th ult., from Her Majesty's Office of Works, and to request that the Board of Trade will be so kind as to state whether it is contemplated that the Committee should, in future, find accommodation for the office out of their annual grant.

The original estimate for the year 1867–8 which was framed to cover the expense of rent, &c., was reduced by the amount of 2,230*l.* in that year, and the amount of 10,000*l.*, at present estimated for, will barely suffice for the work of the office, including the reduction of the observations in process of collection, as their observatories are now all at work.

At the same time I am to say that having instituted inquiries, they fear it will not be possible for them to obtain suitable offices, at a moderate rent, in this vicinity, so that if they are obliged to remove to a greater distance from the three telegraph offices (situated respectively in Great George Street, S.W., at Charing Cross Station, and in Cockspur Street), serious delays in the receipt of weather reports, and the issue to the public of telegraphic warning intelligence must necessarily arise.

Under these circumstances the Committee would request the Board of Trade to inform them whether they could not obtain from Her Majesty's Office of Works office accommodation in the immediate neighbourhood of their present office.

I am, &c.
(Signed) R. H. SCOTT.

Thomas Gray, Esq. Assistant Secretary.

Read—The following letters:—

M. 1695.

SIR, Board of Trade, Whitehall, 24th February 1869.

I AM directed by the Board of Trade to transmit to you to be laid before the Meteorological Committee, a copy of a letter addressed by the Lords Commissioners of the Treasury to this department, relating to the Parliamentary grant of Ten Thousand Pounds to the Royal Society for Meteorological purposes; and to state that this Board will be glad to receive the observations of the Committee thereon.

I am, sir, your obedient servant,
(Signed) THOMAS GRAY.

R. H. Scott, Esq., Meteorological Office.

M. 1695.

SIR, Treasury Chambers, 19th February 1869.

I AM desired by the Lords Commissioners of Her Majesty's Treasury to request that you will call the attention of the Lords of the Committee of Privy Council for Trade to the following statement contained in the memorial from the Scottish Meteorological Society which formed the subject of your letter of the 12th instant, vizt.:—

"Your Lordships, appreciating the force of the society's claims, were pleased to suggest that the "Council of this Society should put itself in communication with the Royal Society Committee, this "body having at its absolute disposal an annual parliamentary grant of 10,000*l.*, and the object of which "grant, as your Lordships stated, is the collecting and reducing of meteorological observations over the "whole of the British Isles.

"From the answer which has been received from the Committee, your Lordships will observe that "the Committee state that they cannot spare any portion of the 10,000*l.* annual grant to assist the "Scottish Meteorological Society."

Under the circumstances my Lords will be glad to be favored with the opinion of the Lords of the Committee as to whether it is necessary to grant so large a subvention as 10,000*l.* a year to the Royal Society for this service, so far as it may be deemed absolutely expedient to carry it on at the public expense.

I am, &c.

The Secretary to the Board of Trade. (Signed) ACTON S. AYRTON.

The following reply was adopted:

SIR,

I AM instructed by the Committee in reply to your letter of the 24th ult. (M. 1695), requesting their observations on a letter from the Treasury dated February 19, in which their Lordships ask "whether it is necessary to grant so large a subvention as 10,000*l.* a year to the Royal Society for this "service, so far as it may be deemed absolutely expedient to carry it on at the public expense," to state that they do not see how any reduction of the sum estimated for by them is possible without seriously impairing the efficiency of the office.

In order to enable the Board of Trade to judge how far this opinion is justified by the facts of the case, I am to submit the following statement of the work now carried on.

It is to be noted that in addition to the study of Land Meteorology, including that not only of England, but of Scotland and Ireland, the Committee are engaged in working out problems connected with the meteorology of the ocean, and that a necessary part of the machinery for carrying out each of these objects is an extended system of weather telegraphy.

I. *Ocean Meteorology.*—The systematic minute investigation of the meteorological conditions of the equatorial portion of the Atlantic Ocean has made steady progress. By this work it is hoped that much light will be thrown on the meteorology of this portion of the sea, traversed by all vessels trading to India, China, and Australia.

The inquiry is necessarily a slow one for the reasons stated in the first annual report of the office. It is conducted nearly on the plan recommended by the Committee of Inquiry, nominated by the Board of Trade, in their report presented to Parliament in 1866, and this work occupies the entire time of four clerks working under the supervision of the Marine Superintendent.

In addition, the Committee have sanctioned the employment of the staff at extra hours in the completion of the unfinished work found by them in the office.

Some portion of this information is already in the press, relating to the temperature of the South Atlantic Ocean, and to the winds of the North and South Atlantic, while the discussion of another portion, consisting of observations taken in the Pacific Ocean, is at present in hands, the materials, when completed, being sent to the Admiralty for embodiment in the Pilot Charts now in course of publication.

In the collection of new materials, the Committee have continued the issue of instruments to captains belonging to the Mercantile Marine Service, drawing the attention of intending observers to the fact that the value of their assistance to the office and to navigation in general depends much more on the quality than on the quantity of the information contained in their registers. They are glad to be able to say that through the ready co-operation of some of our leading ocean steamship companies, the assistance of several first-class observers in their respective services has been secured. In many instances registers have been already sent in by these gentlemen, containing most valuable information, and showing a marked improvement on many that were previously received at the office.

In addition to the above, Her Majesty's Navy has been regularly supplied with all the meteorological instruments used in the service.

As regards instruments out on loan, the number of which was very large, inquiry is being made in each instance, and thereby many instruments, no longer required for the special purpose for which they were originally lent, have been traced and ultimately restored to the public service.

II. *Telegraphic Weather Intelligence.*—The reporting stations, situated nine in England, four in Scotland, and four in Ireland, have all been inspected in the course of the year 1868, and a marked improvement was found in the state of things discovered in existence at the date of the first inspection, and noticed in the first annual report.

The system of Telegraphic Weather Intelligence has been in operation for more than a year, and the drum signal is now hoisted at 100 stations in the United Kingdom, of which 67 are English 26 Scotch, and 7 Irish. In addition, the regular daily exchange of weather reports with the French Government is carried on, while a mutual communication of telegraphic information of storms is in operation between this country and Holland, Norway, and Hamburg. The system thus embraces the entire coast of France, and almost all of that of the North Sea.

The Semaphores erected at Blackwall, Liverpool, and North Shields for the purpose of conveying intelligence of weather to shipping have been on trial for about a year.

In addition to the above, telegraphic information of a special nature is sent to the underwriter's room at Liverpool, the subscribers bearing half the expense of the messages. Copies of the daily

weather report are sent post free to 12 seaports, eight in England, three in Scotland, and one in Ireland, and are also supplied to most of the London daily papers.

In connexion with this branch of their operations, it should be noticed that 106 fishery barometers are out on loan to fishing stations, 51 of which are in England, 38 in Scotland, and 17 in Ireland.

III.—*Land Meteorology of the British Islands.* The seven observatories established by the Committee have been set in operation in the course of the past year. They are situated respectively at Aberdeen, Glasgow, Stonyhurst, Kew, Falmouth, Armagh and Valencia, three being in England, two in Scotland, and two in Ireland. The first few months have been mainly occupied in training the observers to their new duties, viz., the management of the instruments, the photographic manipulation of the records furnished by them, and the reduction of the results to accurate numerical values. This having now been set on a satisfactory basis, the attention of the Committee has been directed to the publication of the results in a form which shall be acceptable to Meteorologists, and shall afford information as to the meteorology of these islands, at least equal in accuracy and completeness to that furnished for the principal States of the European continent by the Meteorological organizations set on foot by their respective Governments. Among these countries Prussia, Austria, Russia, and France may be specially noticed.

Specimens of the curves themselves, which are furnished by the instruments, exhibiting some marked peculiarities of weather, have been lithographed and distributed with the view of eliciting from competent judges opinions as to the advisability of reproducing a more extensive system of similar publications.

In the letter from the Council of the Scottish Meteorological Society, dated October 16, 1868, an application was made for funds to be expended in "collecting meteorological observations." The Committee (*vide* Minutes, 1868, pp. 69, 70, of which a copy is enclosed) expressed their regret at being unable to accept this proposal, for the grounds stated in their letter. Before any extension of their system of observations can be contemplated, it will be necessary for them to ascertain, by preliminary reduction of the results now coming in, the direction in which such extension would be most desirable.

As regards the financial condition of the office, the Committee instruct me to say that if they are required to provide themselves with office accommodation and with furniture, as recently intimated to them by Her Majesty's Office of Works, a serious reduction will have to be made in the sum which they are able to devote to scientific purposes, in order to defray the expenses connected with their new office.

Should the Treasury determine on reducing the vote for the ensuing financial year to a less sum than 10,000*l.* it will be for them to point out the special department of the Committee's operations which they consider should now be curtailed.

I am to state that in the opinion of the Committee the accurate investigation of the Meteorology of the British Islands, by means of the self-recording observatories which they have established, is of paramount importance, as forming the only satisfactory basis on which any inquiry into the conditions and the causes of change of our weather can be undertaken. As before stated, this investigation is only now being commenced, and the Committee have accordingly to increase their staff during the ensuing year, as it will be seen from their first annual report that the time of their clerks is already fully occupied with other work.

The Committee find themselves therefore unable to reduce their estimate of 10,000*l.* without materially interfering with the work of the office and its usefulness to the public.

They subjoin in conclusion a statement of the proportions in which their annual expenditure is divided between the three departments under their superintendence.

| | |
|---|---|
| Ocean Meteorology, including Supply of Instruments to the Admiralty | £4,000 |
| Telegraphy and Telegraphic Weather Intelligence | 3,000 |
| Land Meteorology of the British Islands | 3,000 |
| Total | £10,000 |

I am, &c.

Thos. Gray, Esq. ROBERT H. SCOTT.

Mr. Scott submitted notes of certain offices which he had seen, and which might be suitable for the office. Action on this head was suspended for the present.

Read—A letter from Dr. A. Keith Johnston, Hon. Sec. to the Scottish Meteorological Society, applying for the instruments at present in the hands of the Society's observers, *vide* Minutes 1868, p. 81.

Mr. Scott was instructed to inform Dr. Johnston that the Committee would present the instruments in question to the Society.

Submitted—An application from the fishermen of St. Monance, in Scotland, for the loan of a fishery barometer. Application supported by the Board of Fisheries, Edinburgh. —Granted.

Read—The following letter from Captain Toynbee:

R. H. Scott, Esq., M.A., Director of the Meteorological Office.

Meteorological Office, 2, Parliament Street, London, S.W. February 22, 1869.

SIR,

WITH this I beg to hand you for the consideration of the Committee logs 2374 & 2375, the first being that of Captain S. Brooks of the R.M.S. "City of London" containing 10 passages to and from New York; the other that of Captain J. A. Martyn, now of the R.M.S. "Siberia," containing eight passages to and from New York. The peculiarity in the curves of atmospheric pressure, neatly drawn by Captain Brooks (those of the outward passages being so much more irregular than those of the homeward) led me to take an independent log (Captain Martyn's) to see if it showed the same differences. The result is the paper which I also hand to you for the consideration of the Committee. Captains Brooks and Martyn have each sent in an equally good, if not better log, and I think

it would be encouraging to them if some special notice were taken of their work. I may add that Mr. McIver, the owner of the Cunard Line, has told me during my last visit to Liverpool, that he thought Captain Martyn was making better passages across the Atlantic since he commenced paying such marked attention to meteorology, induced by his keeping so careful a record of the instruments belonging to this office.

I am, &c.
HENRY TOYNBEE.

The paper was referred to Captain Richards and Mr. Galton. Captain Brooks and Captain Martyn to be thanked for their excellent logs.

Mr. Galton submitted a proposal that a weekly summary of the weather in Western Europe should be prepared from the Paris bulletin, and printed every Thursday morning in the daily papers.

Resolved—That the experiment be tried for a month, Mr. Galton kindly undertaking to superintend it for that period.

Mr. Scott reported that he had engaged Mr. Edwin Magrath as a temporary clerk to fill the vacancy mentioned on the Minutes of last Meeting.

The appointment to be for four weeks only; salary 1*l.* per week.—Confirmed.

The following cheques were drawn on February 22d:—

| | £ | *s.* | *d.* |
|---|---|---|---|
| For Salaries for February: | | | |
| R. H. Scott | 66 | 13 | 4 |
| H. Toynbee | 33 | 6 | 8 |
| B. Stewart | 33 | 6 | 8 |
| W. Salmon | 17 | 10 | 0 |
| J. S. Harding, jun. | 13 | 6 | 8 |
| R. Strachan | *15 | 16 | 8 |
| S. Jeffery | †15 | 0 | 0 |
| F. Gaster | 9 | 3 | 4 |
| C. Harding | 8 | 6 | 8 |
| R. H. Curtis | 6 | 19 | 2 |
| F. Steventon | 6 | 13 | 4 |
| J. S. Harding, sen. | ‡6 | 14 | 2 |
| For Instruments: | | | |
| T. Adie, repairs | 5 | 0 | 0 |
| Elliott Brothers ("A" instruments) | 6 | 18 | 0 |
| F. Pastorelli do. | 8 | 6 | 0 |
| Negretti & Zambra do. | 29 | 12 | 0 |
| For Travelling: | | | |
| H. Toynbee, visit to Liverpool | 5 | 6 | 6 |
| For Telegraphy: | | | |
| Magnetic Telegraph Company, January | 61 | 16 | 3 |
| Submarine do. do. | 35 | 11 | 1 |
| For Observatories: | | | |
| T. Kerr, salary for February | 20 | 16 | 8 |
| R. W. Munro, barometer tabulating instruments | 63 | 12 | 0 |
| Office Petty Expenses: | | | |
| J. S. Harding, jun. on account | §25 | 0 | 0 |
| Total | £494 | 15 | 2 |
| Cheque drawn this day: | | | |
| J. S. Harding, jun. Office Expenses | 25 | 0 | 0 |

The Committee then adjourned.

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* Including allowance for care of instruments. † Five weeks, to 27th February.
‡ Four weeks, to 25th February. § Of this amount 15*l.* was drawn on the 15th February.

# METEOROLOGICAL COMMITTEE.

13, *Ashley Place, Monday, March* 15, 1869.

PRESENT:

General Sabine in the Chair.

| | |
|---|---|
| Mr. Gassiot. | Dr. W. A. Miller. |
| Mr. Galton. | Captain Richards. |

The Director and the Secretary to the Committee were in attendance.

The Minutes of the last meeting were read and confirmed.

Mr. Scott reported that the draft letters adopted at last meeting had been sent.

Read the following letter:—

SIR, Office of Works, &c., S.W., March 13, 1869.

WITH reference to your letter of the 25th ulto., requesting to be informed whether it would be possible for the Meteorological Department to purchase of this office any portion of the furniture now used by the Meteorological Department, I am directed by the First Commissioner of Her Majesty's Works, &c., to inform you that the Lords Commissioners of Her Majesty's Treasury have sanctioned the disposal to your department of the presses mentioned in the enclosed list, the value of which is estimated at one hundred and eleven pounds and eight shillings (111*l.* 8*s.* 0*d.*), and I am to request that the sum mentioned may be paid to the credit of Her Majesty's Paymaster General on account of this department, for which purpose the necessary receivable order is enclosed. (List not printed.)

I am, &c.

R. H. Scott, Esq. (Signed) GEORGE RUSSELL, Secretary.

Mr. Scott was instructed to send the following reply:—

SIR, Meteorological Office, March 16, 1869.

I AM instructed by the Committee to inform you that pending the reply of the Board of Trade to their letter of the 2nd inst., respecting the accommodation for their office, they have suspended action on your letter of the 13th inst. (1645-B). They hope that it may be found convenient for them to hold furnished offices from the Board of Works in the immediate vicinity of Whitehall.

I am, &c.

G. Russell, Esq. (Signed) R. H. SCOTT, Director.

Read the following letter:—

Meteorological Society of Scotland, Edinburgh,

DEAR SIR, 4, St. Andrew Square, March 9, 1869.

AT a meeting of the Council held yesterday your letter to me dated 6th instant was read.

In this letter you intimate that the instruments lent to us by the Board of Trade, and now in our possession, have been presented to the Society by the Committee of the Royal Society, and I was requested to communicate through you the thanks of the Council for this valuable gift.

The Council took into consideration a communication from the Lords of the Treasury, dated 19th ultimo, in reply to their memorial for a grant to enable them to carry on the meteorological observations furnished by the Society to the Government.

In this reply their Lordships refer to a former letter in which they state that they do not see their way to recommend an extension of the grant of 10,000*l.* already at the disposal of the Committee of the Royal Society.

The Council seeing that, without such aid, the operations of the Society cannot be carried on satisfactorily, reluctantly come to the conclusion that no alternative is left them but to ask their Lordships to enter into communication with your Committee, in order to ascertain whether any portion of the parliamentary grant could not be set aside for the purposes of the Society.

The Council think it due to your Committee to apprise them of the step about to be taken, and to state that they would have infinitely preferred to have had a special grant for their own purposes.

I am, &c.

R. H. Scott, Esq., Director. (Signed) A. KEITH JOHNSTON.
Meteorological Office.

The question of the discussion of the records coming in from the observatories having been taken into consideration, it was resolved that—

It appears desirable to employ additional clerks for the reduction of the monthly and five-day means of pressure and temperature, commencing with January 1869. Also to ascertain whether the observations of the preceding six months, July to December 1868, be worthy of similar treatment, and to accelerate the marine and other general work of the Office.

Mr. Scott was requested to prepare a report on this subject for the next meeting of the Committee.

The Secretary presented the following report regarding the records for January 1869, received from the self-recording instruments of the various observatories, and which have been examined at Kew in accordance with the regulations adopted by the Meteorological Committee. (See Minutes, 21st December 1868.)

ANEMOGRAPH.

*Aberdeen.*—The anemograph at this station has been in good action during the month. There was, however, a stoppage of the clock between January 13th 11 a.m., and January 14th 3 p.m., by means of which 27 hours were lost both for velocity and direction. The orientation was tested at Aberdeen on February 1st and found correct. No error in tabulation has been discovered at Kew. Forty remeasurements of direction and velocity have been made with the following results:

| | Direction. | | Velocity. |
|---|---|---|---|
| (1.) Greatest difference - - | 0·0 | - - - | 2·0 |
| (2.) Mean difference irrespective of sign | 0·0 | - - - | 0·7 |
| (3.) Residual difference - - | 0·0 | (Aberdeen—Kew) | +0·2 |

*Armagh.*—The anemograms from Armagh for January have not been sent in to the central office. The instrument at this station is somewhat different from the others, and Mr. Stewart is in correspondence with Dr. Robinson regarding the best method of examining the results at the central observatory.

*Falmouth.*—The anemograph at this station has been in good action during the month of January. There was, however, a stoppage of the clock on Sunday 17th January from 4 to 11 a.m., by which six hours were lost both for velocity and direction. Also from 10 a.m. to 2 p.m. on Sunday 31st January the pencil did not touch, by which three hours were lost both for velocity and direction. In all nine hours have been lost during this month for both elements. The orientation of the instrument was examined at Falmouth on January 22nd and found correct. No error in the tabulation has been discovered at Kew. Forty remeasurements of direction and velocity have been made at Kew with the following results:

| | Direction. | | Velocity |
|---|---|---|---|
| (1.) Greatest difference - - | 1·0 | - - - | 2·0 |
| (2.) Mean difference irrespective of sign | 0·1 | - - - | 0·7 |
| (3.) Residual difference - - | 0·0 | (Falmouth—Kew) | +0·3 |

*Glasgow.*—For the first part of the month the traces from the Glasgow anemograph were weak, but there has been latterly a marked improvement in this respect. For a few days the regulation of the clock appears to have been unsatisfactory, but this was then made right. The traces are quite complete with no blanks. One trifling error in direction was discovered and put right, namely, the direction on January 11th 1 a.m., which was originally 10, was changed to 12, which it ought to have been. For January 21st, 22nd, and 23rd, the two daily sum totals of velocity determined, the one by adding the tabulations, and the other from the curve direct, were found to disagree beyond the limit mentioned in the regulations. The curves for these days were therefore examined and partly retabulated. On January 29th Professor Grant examined the orientation and found it correct. Forty remeasurements of direction and velocity have been made at Kew with the following results:

| | Direction. | | Velocity. |
|---|---|---|---|
| (1.) Greatest difference - - | 1.0 | - - - | 2·0 |
| (2.) Mean difference irrespective of sign | 0·1 | - - - | 0·8 |
| (3.) Residual difference - - | +0·1 | (Glasgow—Kew) | 0·0 |

*Kew.*—The Kew anemograph has been in good action during this month. The instrument was examined and its orientation verified on January 12th at 11 a.m. Two hours record of direction were lost in consequence of the examination. There are no other blanks. One error in direction was discovered, the direction on January 31st, 9 p.m., which had been recorded as 22, should have been 18. This was put right. Forty remeasurements were made at Kew with the following results:

| | Direction. | | Velocity. |
|---|---|---|---|
| (1.) Greatest difference - - | 1·0 | - - - | 1·0 |
| (2.) Mean difference irrespective of sign- | 0·0 | - - - | 0·4 |
| (3.) Residual difference - - | 0·0 | ($Kew^1$—$Kew^2$) | +0·1 |

*Stonyhurst.*—The Stonyhurst anemograph has been in good action during the month of January. The instrument was examined, cleaned, and its orientation verified at Stonyhurst on January 22nd, 11 a.m. In consequence of this examination, one hour's record, both of direction and velocity, was unavoidably lost. There are no other blanks. Five errors in direction have been discovered by the subsidiary tables and put right:

| | | | |
|---|---|---|---|
| Jan. 3, | 8 a.m., | direction should be | 27·0 |
| | 9 a.m., | „ „ | 25·5 |
| 13, | 7 p.m., | „ „ | 11·0 |
| 14, | 2 a.m., | „ „ | 13·5 |
| 19, | 4 p.m., | „ „ | 17·0 |

Two errors in the velocity have been discovered by the subsidiary arrangement and put right

Jan. 5, at 9 a.m., mistake of 20 miles : velocity should be 36·0.
16, „ 2 p.m., „ 10 „ „ should be 15·5.

Forty remeasurements have been made at Kew with the following results:

| | Direction. | | Velocity. |
|---|---|---|---|
| (1.) Greatest difference - - | 1·0 | - - - | 2·0 |
| (2.) Mean difference irrespective of sign | 0·0 | - - - | 0·6 |
| (3.) Residual difference - - | 0·0 | (Stonyhurst—Kew) | +0·2 |

*Valencia.*—In consequence of the illness of Mr. Kerr the January records are not yet ready for the central office.

## Barograph.

*Aberdeen.*—The action of the Aberdeen barograph for January as well as the photography has been good, except that for six hours at the commencement of curve No. 2-3 the temperature line is deficient. The same occurs from January 13th, 10.52 a.m., to January 14th, 8 a.m., nevertheless no hourly records have been lost.

The following errors have been discovered and corrected:

In application of residual correction—

| | | | |
|---|---|---|---|
| Jan. | 5, 8 a.m., | 29·157 should be | 29·057 |
| | 10, 1 a.m., | 30·198 „ | 30·199 |
| | 15, 9 p.m., | 29·814 „ | 29·812 |
| | 21, 8 a.m., | 30·094 „ | 30·093 |
| | 9 a.m., | 30·118 „ | 30·117 |
| | 22, 7 a.m., | 30·263 „ | 30·265 |
| | 25, 2 a.m., | 29·812 „ | 29·811 |
| | 31, 6 a.m., | 28·765 „ | 28·764 |

In calculation of residual correction—

Jan. 2, + ·010 should be + ·008.

The Sunday residual corrections have been wrongly calculated for tabulations 2, 3, 4, 5.

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference - - - - - | ·0050 |
| (2.) Mean difference irrespective of sign - - | ·0020 |
| (3.) Residual difference (Aberdeen—Kew) - - | 0006 |

The monthly mean difference between simultaneous barograph and standard readings is ·0019.

*Armagh.*—The action of the Armagh barograph for the month of January, as well as the photography, have been very good, except that there is a bagging in the curves, which shows itself at the commencement of each sheet. The method resorted to for overcoming the effect of this in causing error of tabulation has been described on the tabulation sheets. One hour, namely, that for Sunday, 17th January 11 a.m., has been lost, but the records are otherwise complete.

The following errors have been detected and corrected:

In tabulation—

Jan. 2, noon, tabulated reading 29·481 should be 29·471.

In application of residual correction—

| | | | |
|---|---|---|---|
| Jan. | 19, 2 a.m., | 29·966 should be | 29·963 |
| | 3 a.m., | ·968 „ | 29·965 |
| | 4 a.m., | ·977 „ | 29·974 |
| | 5 a.m., | ·979 „ | 29·976 |
| | 6 a.m., | ·992 „ | 29·989 |

Forty remeasurements have been made at Kew with the following results:

| | | |
|---|---|---|
| (1.) Greatest difference - - - | ·0060 | |
| (2.) Mean difference irrespective of sign - | ·0017 | |
| (3.) Residual difference - - - | —·0005 | (Armagh — Kew) |

The monthly mean difference between simultaneous barograph and standard readings is ·0024.

*Falmouth.*—The Falmouth barograph has been in good action during the month of January, except that the residual corrections have been very irregular. The photography has been good, but curve No. 2-3 is invisible, and there are several photographic blemishes. In consequence of these 52 hourly traces have been lost.

The following errors have been detected and corrected:

In tabulation—

Jan. 29, mid., tabulated reading 29·015 should be 29·105.

In application of residual correction—

| | | |
|---|---|---|
| Jan. | 8, 7 p.m., | 30·276 should be 30·272 |
| | 9, 3 a.m., | 30·286 „ 30·266 |
| | 15, 2 a.m. to 11 p.m., | error of ·002 in applying residual correction. |
| | 26, 4 p.m., | 29·654 should be 29·664 |
| | 27, 6 p.m., | 29·289 „ 29·189 |

In calculating residual correction—

| | | | |
|---|---|---|---|
| Jan. | 4, | ·003 should be | —·001 |
| | 14, | —·002 „ | —·001 |
| | 22, | —·033 „ | —·031 |
| | 29, | —·013 „ | —·012 |

Forty remeasurements have been made at Kew with the following results:

| | | |
|---|---|---|
| (1.) | Greatest difference - - - - - | ·0060 |
| (2.) | Mean difference irrespective of sign - - | ·0026 |
| (3.) | Residual difference (Falmouth—Kew) - - | —·0002 |

The monthly mean difference between simultaneous barograph and standard readings is ·0022.

*Glasgow.*—The Glasgow barograph has been in good action during the month of January, except that the gas went out between 8 and 10 p.m. on the 25th, and there was a stoppage of the clock for about seven hours on the morning of Jan. 31st. In consequence of this seven hours' records have been lost. The photography is good, but some of the sheets are rather discoloured. The residual corrections appear at first to have been irregular in their values.

The following errors have been detected and corrected:

In application of residual correction—

| | | | |
|---|---|---|---|
| Jan. | 5, 3 p.m., | 29·040 should be | 29·050 |
| | 14, midt., | 29·306 „ | 29·307 |
| | 19, 7 p.m., | 30·056 „ | 30·055 |
| | 20, 5 p.m., | 29·906 „ | 29·907 |
| | 23, 8 a.m., | 29·902 „ | 29·904 |
| | 25, 8 a.m., | 29·609 „ | 29·599 |

Forty remeasurements have been made at Kew with the following results:

| | | |
|---|---|---|
| (1.) | Greatest difference - - - - - | ·0050 |
| (2.) | Mean difference irrespective of sign - - - | ·0022 |
| (3.) | Residual difference (Glasgow—Kew) - - | -+·0002 |

The monthly mean difference between simultaneous barograph and standard readings is ·0023.

*Kew.*—The Kew barograph has been in good action during the month of January, and the photography has been good, except that a few sheets are somewhat discoloured.

On January 15th the curve is blurred at 10 a.m., but a standard reading having been taken at that hour the hourly record is not lost. Curve No. 22–23 is distorted at its commencement, and one hour is thus lost; also the gas went out on January 28th between noon and 2 p.m., and one hour's record was lost; altogether two hourly records are deficient.

The following errors have been detected and corrected:

In application of residual correction—

| | | | |
|---|---|---|---|
| January | 19th, 6 a.m., | 30·442 should be | 30·462 |
| „ | 25th, 6 a.m., | 30·106 „ | 30·107 |
| „ | „ 7 a.m., | 30·105 „ | 30·106 |
| „ | „ 8 a.m., | 30·105 „ | 30·106 |
| „ | „ 6 p.m., | 29·979 „ | 29·977 |
| „ | 29th, 4 a.m., | 29·952 „ | 28·952 |
| „ | „ 5 a.m., | 29·994 „ | 28·994 |

Forty remeasurements have been made with the following results:

| | | |
|---|---|---|
| (1.) | Greatest difference - - - - | ·0050 |
| (2.) | Mean difference irrespective of sign - - | ·0012 |
| (3.) | Residual difference ($Kew^1$—$Kew^2$) - - | ·0000 |

The monthly mean difference between simultaneous barograph and standard readings is ·0024.

*Stonyhurst.*—The Stonyhurst barograph has been in good action during the month of January, and the photography has been good, except that curve No. 4–5 is very faint; six hourly records have in consequence been lost.

The following errors have been detected and corrected:

In entry of standard readings—

January 4th, 6 p.m., 29·553 should be 29·453

In calculation of residual correction—

| | | | |
|---|---|---|---|
| January | 8th, | —·005 should be | —·002 |
| „ | 9th, | +·002 „ | —·002 |

In application of residual correction—

| | | | |
|---|---|---|---|
| January | 14th, 11 p.m., | 29·143 should be | 29·153 |
| „ | 16th, 6 a.m., | 29·608 „ | 29·618 |
| „ | 17th, 8 p.m., | 29·850 „ | 29·852 |
| „ | 23rd, 3 a.m., | 29·817 „ | 29·823 |
| „ | „ 4 a.m., | 29·801 „ | 29·807 |
| „ | „ 5 a.m., | 29·789 „ | 29·795 |
| „ | „ 6 a.m., | 29·780 „ | 29·786 |
| „ | 24th, 10 p.m., | 29·712 „ | 29·716 |

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | ·0040 |
| (2.) Mean difference irrespective of sign | ·0018 |
| (3.) Residual difference (Stonyhurst–Kew) | —·0005 |

The monthly mean difference between simultaneous barograph and standard readings is ·0025.

THERMOGRAPH.

*Aberdeen.*—The Aberdeen thermograph has been in good action during the month of January, and the photography is good, except that some of the sheets are slightly discoloured. The clock stopped from Jan. 18th 6 p.m. to Jan. 19th 9 a.m., and again from Jan. 19th 11 a.m. to Jan. 19th 5 p.m.; in consequence of this, 20 hours' records were lost both for the dry and wet bulb. Besides this the wet bulb reading for Jan. 1st 11 a.m. was unavoidably wrong through the action of frost.

The following errors were detected and corrected:

The tabulations of both dry and wet bulb from 1 a.m. 12th Jan. to 10 a.m. Jan. 13th, were slightly but perceptibly wrong and were retabulated at Kew. From 11 a.m. on 17th Jan. till 5 p.m. on 18th the dry and wet bulb readings were slightly but perceptibly wrong and were retabulated at Kew.

Forty remeasurements were made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference | 0·2 | 0·3 |
| (2.) Mean difference irrespective of sign | 0·10 | 0·12 |
| (3.) Residual difference (Aberdeen–Kew) | 0·0 | +0·10 |

The mean monthly difference between simultaneous standard and tabulated readings, is—

| Dry. | Wet. |
|---|---|
| 0·09 | 0·12 |

*Armagh.*—The Armagh thermograph for January has been in good action, and the photography is very good. The clock stopped on January 9th between noon and 2 p.m. On Friday 15th January, the instrument was not in action at 11 a.m., in consequence of the cylinder being altered to take zero line, also the reading at 11 a.m. on 19th Jan. has been rejected on account of bagging. In consequence of this, in all, three hourly values have been lost both for the dry and wet bulb. On January 14th, from 6 to 10 a.m., the wet bulb seems to have been imperfectly wetted, four hours' records are thus lost. No error of any consequence has been detected.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference | 0·3 | 0·2 |
| (2.) Mean difference irrespective of sign | 0·10 | 0·10 |
| (3.) Residual difference (Armagh–Kew) | 0·0 | +0·10 |

The mean monthly difference between simultaneous standard and tabulated readings, is—

| Dry. | Wet. |
|---|---|
| 0·13 | 0·14 |

*Falmouth.*—The Falmouth thermograph has been in good action during the month of January, and the photography is generally good, except that curve No. 2–3 is invisible, in consequence of which 48 hour traces have been lost both for the wet and dry bulbs. In consequence of a photographic blemish one hour's trace of the dry bulb corresponding to January 29th 9 a.m. is also lost. The wet bulb appears to have been insufficiently wet from 3 a.m. to 9 a.m. on January 11th, also at 8 a.m. January 13th, and in consequence of this four hourly records are lost. In all 49 hourly records of the dry bulb and 52 of the wet bulb are lost.

The following error has been detected and put right:

January 14th, 2 a.m., the dry bulb reading was given as 47·0 by both tabulations, whereas it should have been 48·0. There are no other errors of consequence.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign | 0.13 | 0·12 |
| (3.) Residual difference (Falmouth–Kew) | 0·08 | +0·04 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·13 | 0·11 |

*Glasgow.*—The Glasgow thermograph has been in good action during the month of January, and the photography is good. The clock was out of action from 3 p.m. to 8 p.m. and from 10 to midnight of January 5th, in consequence of which six hourly records were lost for both thermometers. It was also out of action from 5 a.m. to 10 a.m. January 8th, in consequence of which five hourly records were lost for both thermometers. Also the gas went out from 1 a.m. to 10 a.m. January 15th, in consequence of which eight hourly records of the dry bulb were lost. Altogether 19 hourly records of the dry and 11 of the wet have been lost in consequence of these circumstances. Besides four hourly records of the wet have been lost through the unavoidable action of frost.

Three errors in the record of maximum temperature have been discovered and put right; no other errors have been detected.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign | 0·11 | 0·11 |
| (3.) Residual difference (Glasgow–Kew) | 0·01 | −0·03 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·08 | 0·10 |

*Kew.*—The Kew thermograph has been in good action during the month of January, and the photography has been good, except that a few sheets are slightly discoloured. The hourly records are complete for the dry bulb thermometer, but one hour's trace has been lost in the case of the wet bulb. Besides this 12 hourly records of the wet bulb are wrong through the action of frost and a series of 16 hours have their values rendered doubtful from the same cause.

The following error in tabulation has been detected in the wet bulb record and put right:

January 28, midnight, 47·7 should be 48·7.

Forty remeasurements have been taken with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - - | 0.2 | 0·3 |
| (2.) Mean difference irrespective of sign - - - | 0·04 | 0·08 |
| (3.) Residual difference ($Kew^1$—$Kew^2$) - - - | 0·0 | + 0·02 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·04 | 0·05 |

*Stonyhurst.*—The Stonyhurst thermograph has been in good action during the month of January and the photography has been very good. The hourly records are complete for both thermometers, but six hourly traces of the wet bulb have been rendered erroneous through the unavoidable action of frost.

The following errors have been detected at Kew, and corrected: two errors in the records of maxima and one in the record of minima, besides other slight errors in these records.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - - | 0·2 | 0·2 |
| (2.) Mean difference irrespective of sign - - - | 0·09 | 0·09 |
| (3.) Residual difference (Stonyhurst—Kew) - - | 0·0 | + 0·05 |

The mean monthly difference between simultaneous standard and tabulated readings, is—

| Dry. | Wet. |
|---|---|
| 0·07 | 0·09 |

In the following table the number of hourly records lost during the month of January is exhibited:

| | Anemograph. | | Barograph. | Thermograph. | | |
|---|---|---|---|---|---|---|
| | | | | Dry. | Wet. | |
| | Direction. | Velocity. | | | Frost. | Other Causes. |
| Aberdeen - - - | 27 | 27 | 0 | 20 | 1 | 20 |
| Armagh - - - | — | — | 1 | 3 | 0 | 7 |
| Falmouth - - - | 9 | 9 | 52 | 49 | 0 | 52 |
| Glasgow - - - | 0 | 0 | 7 | 19 | 4 | 11 |
| Kew - - - - | 2 | 0 | 2 | 0 | *12 | 1 |
| Stonyhurst - - - | 1 | 1 | 6 | 0 | 6 | 0 |

The Committee directed that the proofs of the Minutes should in future be only sent in slips to the various members.

It was resolved that the sum of 1,500*l.* be drawn from the deposit account in the London and Westminster Bank, and be lodged to the current account of the Committee in the Bank of England.

The following cheques were drawn:—

| | | | £ | *s.* | *d.* |
|---|---|---|---|---|---|
| For Glasgow agency:— | | | | | |
| A. Small - - - - - - | | | 2 | 10 | 0 |
| For Telegraphy:— | | | | | |
| Anglo-American Company, to December 31 - | | | 164 | 18 | 6 |
| Electric Company, December - | £86 14 7 | | | | |
| Do. January - | 69 11 8 | | | | |
| | | | 156 | 6 | 3 |
| Magnetic Company, February - - - | | | 56 | 13 | 3 |
| Submarine do. do. - - - | | | 33 | 14 | 0 |
| | | | £414 | 2 | 0 |

* 16 readings are also rendered doubtful.

Mr. Scott reported that since the meeting of the 23d November last, applications for telegraphic weather intelligence have been received from

Cromer, Brighton, and Pembrey,

and that Cromer and Brighton having been approved by the Board of Trade have been placed on the list of stations warned.

The Committee then adjourned.

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## METEOROLOGICAL COMMITTEE.

13, *Ashley Place, Monday, March* 22, 1869.

PRESENT:

General Sabine in the Chair.

| | |
|---|---|
| Mr. Gassiot. | Dr. W. A. Miller. |
| Captain Richards. | Mr. Spottiswoode. |

The Director and the Secretary to the Committee were in attendance.

The printed copies of the minutes for March 15th not having arrived, their confirmation was postponed until next meeting.

Mr. Scott submitted the following report:

I find that if the committee are permitted to retain their present office and to occupy all the rooms in the house, accommodation could be provided for about eight additional clerks.

Of these three might very advantageously be employed on the branch of ocean meteorology. If this change be made additional assistance will be requisite to enable Captain Toynbee to prepare registers at a rate sufficient to keep the staff at work. It is probable that some of the clerks in the office at present may be trained to do this, in accordance with the subjoined directions.

Two might be employed in assisting Mr. Gaster in the study of weather from the curves of the observatories, three in assisting Mr. Jeffery in the calculation of numerical results from the tabulations of the curves.

Mr. Jeffery finds that the calculation of the *monthly* means for each element (wind excepted) would take one person about 10 hours for the seven observatories per month. The *five day* means would take 1½ hour additional. Accordingly the numerical results for pressure and temperature for the past six months could be calculated in about six weeks by one person, allowing for unavoidable delays. The records to be furnished to the computer in a condition similar to those now sent in from Kew.

ROBERT H. SCOTT.

Resolved—That Capt. Toynbee's directions be printed for consideration.

Resolved—That Mr. Scott be authorized to engage additional assistance in accordance with the foregoing report. The names of candidates for employment to be submitted to the Committee, also that the calculation of the results for the observatories mentioned in the foregoing report be proceeded with.

Read a letter from Dr. Buys Ballot, of Utrecht, of which the following is an extract:

Utrecht, 13 March 1869.

We have gathered the temperature observations of the sea water in the North Atlantic, South Atlantic, and of some in the Indian ocean, and have disposed them for every square degree. You are doing the same or have done so. What if you choose one of the oceans, we another? I would send to you our data for the North Atlantic and you would publish them together with the English observations and a preface in English and Dutch. We would do exactly the same for the South Atlantic, using your English observations.

If we could agree about the manner of disposition and of publication, each of the two inquiries would rest on all the observations as a whole, and perhaps the cost of printing would be less for each of us. I should like very much to have your opinion known on this subject.

In September 6–11 we shall have an international meeting of statistical men at the Hague, should you incline to come there. In this case I would propose the same to other meteorologists, Dove, Jelinek, Buchan, Wild, Muhry, to the successor of Matteucci, &c. In that case we could form a Meteorological Association as a section of the Statistical Congress.

(Signed) BUYS BALLOT.

R. H. Scott, Esq.

Resolved—That Mr. Scott send the following reply:

With reference to your letter of March 13, in which you propose that we should join with the Institution of the Netherlands in the discussion of Ocean Temperatures, I am instructed by the committee to say that they would be very happy to work in harmony with your office. Their materials

are, however, not in a condition which would justify their undertaking such a work as you propose, for, as you will learn from our Report, we are only now commencing the extraction of materials for single square degrees. This work has been begun for the district in the Atlantic bounded by 20° N. and 10° S., and some sea temperatures have been extracted. To these you are freely welcome, but the Committee could not promise to let you have anything like a complete copy of all the observations accumulated in this office within a reasonable time, without entirely interrupting their work.

As regards your kind invitation to the Statistical Congress at the Hague, I fear that we must most respectfully decline it. The work of this office is definitely laid out, and the Committee would scarcely be able to change their plans as regards it.

The Secretary reported that during a very strong gale at Falmouth on Friday last one of the cups of the anemograph had been blown away, but the instrument continued in action with three cups and steps were being taken to repair the damage.

He also stated that he proposed sending Mr. Beckley to Armagh to investigate into the cause of the apparent bending of the barograph curves and if possible to put the instrument right.

The Secretary presented the following report regarding the records for February 1869, received from the self-recording instruments of the various observatories, and which have been examined at Kew in accordance with the regulations adopted by the Meteorological Committee. (See Minutes of Dec. 21, 1868.)

ANEMOGRAPH.

*Aberdeen.*—The general action of the instrument has been good during the month.
The orientation was tested on February 18th at 3.40 p.m. and found correct.
The traces are quite complete with no blanks.
No errors of tabulation have been discovered at Kew.
Forty remeasurements of direction and velocity have been made with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference - - - - | - 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign - - | - 0·2 | 0·6 |
| (3.) Residual difference (Aberdeen—Kew) - | + 0·1 | + 0·3 |

*Armagh.*—The anemograms for February have not been sent in to the central office, as Mr. Stewart has not yet decided upon the method of examining the results at the central observatory.

*Falmouth.*—The general action of the instrument has been good during the month.
There was however a stoppage of the clock by which three hourly values, both of direction and velocity, viz., those from 8 a.m. to 10 a.m. of the 13th February, have been lost.
The orientation was tested on February 18th at 10.40 a.m. and found correct.
No errors of tabulation have been discovered at Kew.
Forty remeasurements of direction and velocity have been made with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference - - - - | - 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign - - | - 0·2 | 0·5 |
| (3.) Residual difference (Falmouth—Kew) - | - 0·0 | + 0·3 |

*Glasgow.*—The general action of the instrument has been good during the month, but the velocity pencil was not in action from February 13th 4.30 p.m. to February 14th 2.30 a.m. In consequence of this 18 hourly values have been lost; records otherwise complete.
One small mistake discovered in the application of friction correction.
Forty remeasurements of direction and velocity have been made with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference - - - - | - 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign - - | - 0·2 | 0·9 |
| (3.) Residual difference (Glasgow—Kew) - | - 0·0 | + 0·4 |

*Kew.*—The general action of the instrument has been good during the month. The orientation was tested on March 10th, at 10·30 a.m., and found to be less than a point wrong, and was put right.
The traces are quite complete with no blanks.
The following errors in direction have been discovered, viz.:

Feb. 6th, 8 a.m., direction should be 18
9 a.m., „ „ 18
10 a.m., „ „ 18

Forty remeasurements of direction and velocity have been made with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference - - - - | - 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign - - | - 0·1 | 0·3 |
| (3.) Residual difference ($Kew^1$—$Kew^2$) - - | - 0·0 | —0·1 |

*Stonyhurst.*—The general action of the instrument has been good during the month. The orientation was tested on February 22nd and found correct. The traces are complete with the exception that the hourly record corresponding to February 19th, 11 a.m., is deficient both for velocity and direction.

The following errors in column of velocity discovered, viz.:

Feb. 4th, 10 a.m., velocity should be 13·0
5th, 5 a.m., „ „ 14·0

Forty remeasurements of direction and velocity have been made with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign | 0·1 | 0·6 |
| (3.) Residual difference (Stonyhurst—Kew) | +0·1 | +0·3 |

*Valencia* (January).—The general action of the instrument has been good during the month. The clock, however, has been slightly out in the regulation. The orientation was tested on the 31st January and found correct. The records are complete with the following exceptions: the hourly trace, both of direction and velocity, for January 1st, 11 a.m., was unavoidably lost on account of oiling the wheels; also the three hourly values of direction for January 6th, 11 a.m. to 1 p.m., were lost from the same cause. There is no record of direction from January 10th 11 a.m. to 6 p.m. In all one hourly value for velocity and 12 for direction have been lost. The following errors in velocity have been discovered, viz.:

Jan. 6th, 1 a.m., velocity should be 15·0
„ 11 a.m., „ „ 5·0
20, 6 a.m., „ „ 35·0

Forty remeasurements of direction and velocity have been made with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 3·0 |
| (2.) Mean difference irrespective of sign | 0·5 | 1·3 |
| (3.) Residual difference (Valencia—Kew) | +0·2 | +0·7 |

*Valencia* (February).—The general action of the instrument has been good during the month. The regulation of the clock has been improved, but there was a stoppage on February 22nd from 3 a.m. to 8 a.m., in consequence of which six hourly records of velocity and direction have been lost; the records otherwise complete.

One or two trifling alterations in the velocity tabulation have been made at Kew.

Forty remeasurements of direction and velocity have been made with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 2·0 | 3·0 |
| (2.) Mean difference irrespective of sign | 0·1 | 0·8 |
| (3.) Residual difference (Valencia—Kew) | +0·1 | −0·1 |

## Barograph.

*Aberdeen.*—The action of the barograph has been good during this month; the photography has also been good but there was a failure of gas extending from February 26th, 6 p.m. to 8 p.m., in consequence of which two hourly records have been lost.

The following errors have been detected and corrected:

In calculating the residual correction—

Feb. 6, −·002 should be −·006
14, +·002 „ +·001
19, −·001 „ −·002

In application of residual correction—

Feb. 3, 4 p.m., 29·531 should be 29·521
27, 8 p.m., 29·520 „ 29·517

Forty remeasurements have been made at Kew with the following results:

| | In. |
|---|---|
| (1.) Greatest difference | 0·006 |
| (2.) Mean difference irrespective of sign | 0·0030 |
| (3.) Residual difference (Aberdeen—Kew) | +0·0005 |

The monthly mean difference between simultaneous barograph and standard readings is ·0022.

*Armagh.*—The action of the barograph has been good during the month of February; the photography has also been very good, but there is still the appearance of bagging in the curves.

The two hourly records for 11 a.m. and noon on February 22nd have been lost, also five hourly records extending from 11 a.m. to 3 p.m. of February 26th; traces are otherwise complete. In all seven hourly records have been lost.

The following errors have been detected and corrected:

In calculating the residual correction—

Feb. 18, +·016 should be +·015

In applying the residual correction—

Feb. 21, 3 a.m., 29·692 should be 29·690
28, 8 a.m., 29·589 „ 29·588

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0070 |
| (2.) Mean difference irrespective of sign | 0·0025 |
| (3.) Residual difference (Armagh—Kew) | +0·0013 |

The monthly mean difference between simultaneous barograph and standard readings is ·0024.

*Glasgow.*—The action of the barograph has been good during the month of February, also the photography, but the hourly record for Feb 7th 2 p.m. has been lost through a photographic blemish; the records are otherwise complete.

The following errors have been detected and corrected:

In calculating the residual correction—

Feb. 11, +·023 should be +·021

In applying the residual correction—

Feb. 14, midnight, 30·106 should be 30·006.

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0050 |
| (2.) Mean difference irrespective of sign | 0·0022 |
| (3.) Residual difference (Glasgow—Kew) | +0·0007 |

The monthly mean difference between simultaneous barograph and standard readings is 0·0027.

*Kew.*—The action of the barograph has been good for the month of February, also the photography, very good. A photographic blemish occurred on Feb. 2 at 10 a.m. but as the standard was then read, no hourly record has been lost.

The following errors have been detected and corrected:

In tabulation—

Feb. 9, 6 a.m., 29·587 should be 29·537.

In calculating the residual correction—

Feb. 22 —·003 should be —·002.

In applying the residual correction—

| | | | |
|---|---|---|---|
| Feb. | 6, 9 a.m., | 30·179 should be | 30·139 |
| | 6, 10 a.m., | 30·179 „ | 30·139 |
| | 16, 1 p.m., | 30·069 „ | 30·059 |

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0060 |
| (2.) Mean difference irrespective of sign | 0·0023 |
| (3.) Residual difference ($Kew^1$—$Kew^2$) | —0·0010 |

The monthly mean difference between simultaneous barograph and standard readings is 0·0020.

*Stonyhurst.*—The action of the barograph has been good for the month of February. The photography has also been good and the records are complete.

The following errors have been detected and corrected:

In tabulation—

Feb. 18, 11 p.m., 29·341 should be 29·441.

In calculating residual correction—

| | | | |
|---|---|---|---|
| Feb. | 3, | +·003 should be | +·001 |
| | 5, | ·000 „ | —·002 |
| | 11, | —·002 „ | ·000 |
| | 15, | +·001 „ | —·002 |
| | 23, | —·006 „ | —·005 |

In application of residual correction—

| | | | |
|---|---|---|---|
| Feb. | 1, 11 a.m., | 28·423 should be | 28·422 |
| | 27, 1 p.m., | 29·632 „ | 29·630 |

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0070 |
| (2.) Mean difference irrespective of sign | 0·0023 |
| (3.) Residual difference (Stonyhurst—Kew) | —0·0004 |

The monthly mean difference between simultaneous barograph and standard readings is 0·0026.

*Falmouth.*—The action of the barograph for the month of February was good. The photography was also good. There are, however, several photographic blemishes. One occurred at 10 a.m. on February 6th, but as the standard reading was then taken no hourly record was lost. Another occurred on February 16th at 10 a.m. by means of which one hourly record is lost, and another also on February 20th at 10 a.m., but a standard reading having been taken no hourly record was lost.

On February 28th one of the binding rods sprung loose, in consequence of which three hourly records, from 8 a.m. to 10 a.m., have been lost. One however was supplied by a standard reading. In all three hourly records have been lost.

The following errors have been detected and corrected:

In entry of standard reading—

February 28th, 2 p.m., 29·952 should be 29·905

In calculating residual correction—

February 15th — ·022 should be — ·023
„ 22nd — ·021 „ — ·029

Forty remeasurements have been made at Kew with the following results:

(1.) Greatest difference - - - - - - 0·0060
(2.) Mean difference irrespective of sign - - - - 0·0023
(3.) Residual difference (Falmouth—Kew) - - - —0·0001

The monthly mean difference between simultaneous barograph and standard reading is 0·0021.

THERMOGRAPH.

*Aberdeen.*—The general action of the instrument has been good during February, and the photography has been also good. The gas failed on February 7th at 7 p.m. and on February 14th at 7 p.m., in consequence of which two hourly records of the wet bulb have been lost. Water was added at 9 a.m. on February 2nd, in consequence of which one hourly record of the wet bulb has been lost. The following readings of the wet bulb have been rendered doubtful or wrong from the action of frost:

February 2nd, 10 a.m. to 7 p.m., and 11 p.m. to midnight.
February 3rd, 1-2 a.m. and 7-8 a.m.
February 15th, 5-8 a.m.
February 27th, 3-5 p.m.

In all 23 hourly records of the wet bulb have been lost from this cause, and 26 hourly records from all causes together. The hourly records for the day bulb are quite complete.

The following errors have been detected and put right:

The tabulation of the wet bulb from February 11th, 10 a.m., till February 12th, 10 a.m., was found to be wrong, the scale having been set by an incorrect standard reading.

The minimum for February 3rd should be 31·7, and that for February 6th 42·3.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - - | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign - - | 0·12 | 0·12 |
| (3.) Residual difference (Aberdeen—Kew) - - | +0·03 | —0·06 |

The mean monthly difference between simultaneous standard and tabulated readings, is—

| Dry. | Wet. |
|---|---|
| ·12 | ·14 |

*Armagh.*—The general action of the instrument during February has been good, and the photography also has been very good. The instrument was not started during the hours of 11 and noon on February 22nd, in consequence of which two hourly records have been lost for both bulbs. The wet bulb was out of action on February 23rd, 4 p.m., but as the standard was then read the hourly record has not been lost.

Nine hourly records, viz., those from 4 a.m. till noon on February 28th have been unavoidably lost from the action of frost.

In all two hourly records have been lost for the dry bulb, and 11 for the wet bulb.

The following errors have been detected and put right:

The wet bulb readings from February 8th, 11 a.m., until February 10th, 10 a.m., were found to be wrong through an erroneous setting of the scale. The dry bulb reading of February 19th, 7 a.m., was 39·9, should be 39·2. The dry bulb readings for February 21st, 1 p.m., was 46·6, should be 46·1.

The minimum on February 7th should be 44·9. The maximum on February 21st should be 46·4, and that on February 26th 51·2.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - - | 0·2 | 0·2 |
| (2.) Mean difference irrespective of sign - - | 0·06 | 0·09 |
| (3.) Residual difference (Armagh—Kew) - - | —0·02 | +0·07 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| ·15 | ·15 |

*Falmouth.*—The general action of the instrument for February has been good, and the photography has also been good. The hourly records for the dry bulb are quite complete. The wet bulb was not in proper action from 6 a.m. to 8 a.m. on February 13th; also from 9 a.m. till noon and from 2 p.m. till 4 p.m. of February 27th. In consequence of this seven hourly records of the wet bulb have been lost.

The following errors in tabulation have been detected and put right:

Feb. 8, 9 p.m., wet bulb was 49·1, should be 48·2
25, 9 p.m., dry bulb was 51·8, „ 50·8

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - - | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign - - - | 0·10 | 0·12 |
| (3.) Residual difference (Falmouth — Kew) - - | +0·03 | 0·0 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| ·09 | ·09 |

*Glasgow.*—The general action of the instrument during February has been good, and the photography has also been good. The hourly records of the dry bulb are quite complete. The four hourly records of the wet bulb from 7 to 10 p.m. of February 28th have been unavoidably lost from the action of frost.

The following errors have been detected and put right:

In tabulation—

Feb. 1, 9 p.m., dry bulb was 40·0, should be 41·0
3, 11 p.m., „ 40·6, „ 41·6
17, 9 p.m., „ 42·3, „ 43·3
19, 8 a.m., „ 36·7, „ 35·7

The maximum for February 7th should be 51·3.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign - - | 0·08 | 0·13 |
| (3.) Residual difference (Glasgow—Kew) - - | —0·02 | —0·10 |

The mean monthly difference between simultaneous standard and tabulated readings, is—

| Dry. | Wet. |
|---|---|
| 0·09 | 0·10 |

*Kew.*—The general action of the instrument during February has been good, and the photography good.

The hourly records are quite complete for both bulbs.

No errors have been discovered.

Forty remeasurements have been made with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·2 | 0·2 |
| (2.) Mean difference irrespective of sign - - | 0·06 | 0·06 |
| (3.) Residual difference Kew [1] — Kew [2] - - | —0·06 | + 0·02 |

The mean monthly difference between simultaneous standard and tabulated readings, is—

| Dry. | Wet. |
|---|---|
| 0·04 | 0·05 |

*Stonyhurst.*—The general action of the instrument during February has been good, and the photography has also been very good. The hourly records for the dry bulb are quite complete. The four hourly records of the wet bulb, extending from noon to 3 p.m. of February 28th, have been unavoidably lost from the action of frost.

The following errors have been detected and put right:

In entry of standard readings—

Feb. 14, noon, dry bulb should be 46·8
22, 2 p.m., wet bulb „ 35·1

In tabulation—

Feb. 2, 1 a.m., wet bulb was 50·5, should be 40·5

In maxima and minima—

Feb. 8, minimum should be 45·9
17, „ should be at 11 p.m.
27, „ „ „ 8.55 p.m.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign - - | 0·10 | 0·10 |
| (3.) Residual difference (Stonyhurst—Kew) - - | —0·07 | —0·09 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·09 | 0·11 |

*Valencia* (January—chiefly tabulated at Kew).—The general action of the instrument during January has been good, and the photography is also good. The hourly records are quite complete for both bulbs.

The following errors have been discovered and put right:

In tabulation—

| | | | | | |
|---|---|---|---|---|---|
| Jan. 20, | 3 a.m., | wet bulb | was 40·0, | should be | 50·0 |
| | 4 a.m., | „ | „ 40·3, | „ | 50·3 |
| | 5 a.m., | „ | „ 40·4, | „ | 50·4 |
| | 6 a.m., | „ | „ 40·4, | „ | 50·4 |
| 29, | 7 p.m., | dry bulb | „ 46·0, | „ | 46·5 |
| 31, | 11 p.m., | wet bulb | „ 44·0, | „ | 45·0 |

Also the tabulation of the dry bulb is wrong from January 19th 11 a.m. to January 21st 10 a.m. through an erroneous setting of the scale.

In maxima and minima—

| | | | |
|---|---|---|---|
| Jan. 16, | minimum | should be | 50·4 |
| 18, | maximum | „ | 52·2 |
| | minimum | „ | 49·7 |
| 19, | maximum | „ | 52·4 |
| | minimum | „ | 50·2 |
| 21, | minima | „ | 39·0 |
| 29, | maximum | „ | 49·4 |

Forty remeasurements were made with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | - 0·2 | 0·3 |
| (2.) Mean difference irrespective of sign - - | - 0·05 | 0·09 |
| (3.) Residual difference (Valencia—Kew) - - | —0·02 | +0·07 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| ·13 | ·13 |

*Valencia* (February—partly tabulated at Kew).—The general action of the instrument during February has been good, and the photography has also been good. The hourly records are quite complete for both bulbs.

The following errors have been detected and put right:

In entry of standard readings several errors have occurred.

In tabulation—

| | | | | | |
|---|---|---|---|---|---|
| February | 6th, 11 p.m., | dry bulb | was 52·8, | should be | 52·2 |
| „ | 9th, 11 a.m., | „ | „ 48·5, | „ | 49·5 |
| „ | „ 11 a.m., | wet bulb | „ 44·5, | „ | 45·2 |
| „ | 12th, 9 a.m., | „ | „ 41·2, | „ | 42·2 |
| „ | 17th, 11 p.m., | dry bulb | „ 44·0, | „ | 45·2 |
| „ | 18th, 4 a.m., | „ | „ 43·9, | „ | 43·2 |
| „ | „ 5 a.m., | „ | „ 42·9, | „ | 42·2 |
| „ | „ 8 a.m., | „ | „ 41·9, | „ | 41·3 |
| „ | „ 9 a.m., | „ | „ 42·9, | „ | 42·2 |
| „ | „ 11 p.m., | wet bulb | „ 41·4, | „ | 43·4 |
| „ | 20th, 11 a.m., | dry bulb | „ 48·0, | „ | 49·0 |
| „ | „ 11 a.m., | wet bulb | „ 46·5, | „ | 47·2 |
| „ | „ 3 p.m., | dry bulb | „ 48·0, | „ | 49·1 |
| „ | 27th, 3 p.m., | wet bulb | „ 42·5, | „ | 43·1 |

The dry bulb tabulation from February 14th 11 a.m. till Feb. 16th 10 a.m. were incorrect through an erroneous setting of the scale.

Several errors of maxima and minima have also been detected.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - - | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign - - - | 0·10 | 0·13 |
| (3.) Residual difference (Valencia—Kew) - - | — 0·07 | — 0·07 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| ·09 | ·13 |

In the following table the number of hourly records lost during the month of February is exhibited.

| ——— | Anemograph. | | Barograph. | Thermograph. | | |
|---|---|---|---|---|---|---|
| | | | | Dry. | Wet. | |
| | Direction. | Velocity. | | | Frost. | Other Causes. |
| Aberdeen - - - | 0 | 0 | 2 | 0 | 23 | 3 |
| Armagh - - - | — | — | 7 | 2 | 9 | 2 |
| Falmouth - - - | 3 | 3 | 3 | 0 | 0 | 7 |
| Glasgow - - - | 0 | 10 | 1 | 0 | 4 | 0 |
| Kew - - - - | 0 | 0 | 0 | 0 | 0 | 0 |
| Stonyhurst - - - | 1 | 1 | 0 | 0 | 4 | 0 |
| Valencia - - - | 6 | 6 | — | 0 | 0 | 0 |

The following cheques were drawn:

| | £ | s. | d. |
|---|---|---|---|
| For Salaries for March: | | | |
| R. H. Scott | 66 | 13 | 4 |
| H. Toynbee | 33 | 6 | 8 |
| B. Stewart | 33 | 6 | 8 |
| W. Salmon | 17 | 10 | 0 |
| J. S. Harding, junior | 13 | 6 | 8 |
| R. Strachan | *15 | 16 | 8 |
| S. Jeffery | †13 | 10 | 0 |
| F. Gaster | 9 | 3 | 4 |
| C. Harding | 8 | 6 | 8 |
| R. H. Curtis | 6 | 19 | 2 |
| F. Steventon | 6 | 13 | 4 |
| E. Magrath | ‡4 | 0 | 0 |
| J. S. Harding, senior | §9 | 6 | 1 |
| For Instruments: | | | |
| J. J. Hicks | 1 | 0 | 0 |
| For Telegraphy: | | | |
| Anglo-American Company, Allowance to Heart's Content Observer | 9 | 5 | 0 |
| Electric Company, February £75 3 4 | | | |
| „ Special Charges, January 21 1 7 | | | |
| | 96 | 4 | 11 |
| For Contingencies: | | | |
| R. H. Scott, extra work of Staff | 71 | 16 | 3 |
| E. Higgs, Carpenter | 7 | 3 | 0 |
| Office, Petty Expenses: | | | |
| J. S. Harding, junior, on account | 25 | 0 | 0 |
| Total | £448 | 7 | 9 |

* Including allowance for care of Instruments.

† 4½ weeks ending 31st instant.

‡ 4 „ „ 27th „

§ 4⅚ „ „ 31st „

The Committee then adjourned.

# METEOROLOGICAL COMMITTEE.

13, *Ashley Place, Monday, April* 5, 1869.

PRESENT:

General Sabine in the Chair.

Mr. Gassiot. | Dr. W. A. Miller.
Captain Richards. |

The Director and the Secretary to the Committee were in attendance.

The Minutes of the last two meetings were read and confirmed.

Mr. Scott reported that the letter to Dr. Buys Ballot, which had been approved at last meeting, had been sent.

Read—A letter from M. Le Verrier, requesting that the Committee would furnish him with extracts from ships' logs in the Atlantic Ocean during the year 1866, to aid in the preparation of the "Atlas des Mouvements Généraux de l'Atmosphère" for that year.

Mr. Scott stated that similar extracts for the year 1865 had been supplied by permission of the Committee (Minutes, 1868, pp. 5 and 35). The exact cost of copying had been—

| | £ | *s.* | *d.* |
|---|---|---|---|
| Ships' logs | 15 | 15 | 0 |
| Army Medical Department Observations and Sunday Weather Reports | 6 | 12 | 6 |
| Total | £22 | 7 | 6 |

Resolved—That Mr. Scott be authorized to supply M. Le Verrier with the required information, the work to be done by the clerks at extra hours.

Read—A suggestion from Captain Toynbee, to the effect that copies of the Admiralty Pilot Charts should be supplied to such captains as had kept "excellent" registers.

Resolved—That 25 copies be ordered, and that same be presented by the office to such observers as Captain Toynbee might recommend to the Committee for the honour.

The officers and clerks were reappointed for the ensuing financial year, at the following salaries:—

| | | | |
|---|---|---|---|
| R. H. Scott, Director of the office | £800 | 0 | 0 |
| Capt. H. Toynbee, Marine Superintendent | 400 | 0 | 0 |
| B. Stewart, Secretary to the Committee | 400 | 0 | 0 |
| W. Salmon, Chief Clerk | 220 | 0 | 0 |
| J. S. Harding, Jun., Senior Clerk | 170 | 0 | 0 |
| R. Strachan, Senior Clerk (with £50 additional for instruments) | 150 | 0 | 0 |
| S. Jeffery, Senior Clerk* | 156 | 0 | 0 |
| F. Gaster, Senior Clerk | 130 | 0 | 0 |
| C. Harding, 1st Junior Clerk | 110 | 0 | 0 |
| R. H. Curtis, 2nd Junior Clerk | 90 | 0 | 0 |
| F. Steventon, Junior Clerk | 80 | 0 | 0 |
| J. S. Harding, Sen., Clerk and Office Keeper* | 100 | 0 | 0 |
| Rev. Thos. Kerr, Director of Valencia Observatory | 250 | 0 | 0 |

Mr. Gaster was accordingly promoted to be a senior clerk (Minutes, 1868, p. 100).

* These salaries are at a weekly rate.

Mr. C. Harding to be 1st junior clerk.

Mr. R. Curtis to be 2nd junior clerk; the salary of that office to rise 10*l.* per annum, to a maximum of 130*l.* (Minutes, 1867, p. 16).

Mr. Scott submitted the names of four candidates for temporary clerkships, as authorized at last meeting, and these gentlemen were accordingly appointed.

E. Magrath, S. Spencer } at 25*s.* per week.
G. Francis, G. Brodie } at 15*s.* per week.

Mr. Scott requested permission to make arrangements for erecting a self-recording anemometer at Yarmouth, in order to obtain accurate records of the force of the wind at that station.

Resolved—That Mr. Scott be authorized to order two anemometers, and to make arrangements for having one erected at Yarmouth; the proposal to be submitted to the Committee for approval before the arrangements are completed.

Resolved—That a letter be written to the Secretary of the Treasury, requesting an imprest of 2,000*l.* for the expenses of the office, until such time as the estimate should be passed.

Resolved—That Mr. Gassiot and Mr. Spottiswoode be requested to act as auditors of the accounts of the office for the past year.

Mr. Scott stated that the whole of the sum of 100*l.* voted on the 23d November 1868, for payment of the clerks for work done at extra hours, had not been expended. He requested permission to continue the work.

Resolved—That Mr. Scott be permitted to expend a sum not exceeding 50*l.* on this work.

The Secretary stated that Mr. Beckley had returned from Armagh. When there, having consulted with Dr. Robinson, it was deemed desirable to make an effort to discover the cause of bending in the traces of the Armagh barograph, even though this should cause a break in the continuity of the records. This resolution was deemed desirable, whether the interests of Armagh alone were regarded, or the perfection of the general system, since there appeared to be no reason why the same thing might not occur at some other of the observatories. Nearly six days' traces have in consequence been lost, but observations of the standard have been made during the interval, which will afford a tolerably good record of the pressure.

The subject was very perplexing, but it was ascertained that a similar but less distortion may be produced by bagging of the paper on the cylinder, there being some peculiarity in the Armagh instrument which makes a very small amount of bagging perceptible. It was thought that this peculiarity might be in the lens.

I should propose that if Dr. Robinson's assistant finds that he cannot, after employing the utmost care, prevent distortion, a new cylinder should be supplied to Armagh, with a more complete arrangement for tightening the paper; this could be done without any further break.

Certain Armagh anemograph curves were taken over to Ireland by Mr. Beckley, and were there tabulated both by Dr. Robinson and him. I am now sufficiently informed regarding these curves to examine the Armagh anemograph tabulations at Kew, and the examination is being proceeded with.

Resolved—That Mr. Stewart be authorized, if necessary, to procure a new cylinder for the Armagh barograph.

The Secretary stated that the Falmouth anemometer had been started again at 11. 21 a.m. of March 24th, with a new cup firmly soldered on.

The amount of record lost in consequence was,

Direction, about 1 hour 20 minutes.
Velocity „ 24 hours.

The Secretary brought the special condition of the Falmouth observatory before the Committee.

Resolved—That a sum, at the rate of 15*l.* per annum, be given for the financial year ending March 31, 1870, to Falmouth, in order to procure assistance to the observer.

Mr. Scott reported that the following cheques were drawn on the 29th March:—

| | £ s. d. | £ s. d. |
|---|---|---|
| For Instruments: | | |
| Adie & Son, repairs | | 4 11 0 |
| L. P. Casella, M.O. account | 10 17 2 | |
| Ditto A. account | 61 15 0 | |
| | | 72 12 2 |
| Elliott, Bros., A. account | | 6 15 6 |
| Negretti and Zambra { A. account | 3 9 6 | |
| Negretti and Zambra { M.O. account | 0 5 6 | |
| | | 3 15 0 |
| For Agencies: | | |
| H. Smart, Liverpool | | 6 11 7 |
| Z. Scaping, Hull | | 3 2 2 |
| For Observatories: | | |
| B. Stewart, for Kew Committee— | | |
| Allowances, March quarter | 112 10 0 | |
| Postages to Observatories | 10 12 10 | |
| Lamp glasses for „ | 1 11 4 | |
| Remeasurement of curves | 25 0 0 | |
| | 149 14 2 | |
| Less Anemograph forms | 3 10 10 | |
| | | 146 3 4 |
| D. Thomson, Aberdeen— | | |
| Allowance, March quarter | 62 10 0 | |
| Less sundries supplied | 3 18 10 | |
| | | 58 11 2 |
| T. R. Robinson, Armagh— | | |
| Allowances, March quarter | 28 15 0 | |
| Expenses „ | 16 7 10 | |
| | | 45 2 10 |
| W. P. Dymond, Falmouth— | | |
| Allowance, March quarter | 62 10 0 | |
| Postages, &c. „ | 2 1 6 | |
| | 64 11 6 | |
| Less sundries supplied | 4 2 10 | |
| | | 60 8 8 |
| R. Grant, Glasgow— | | |
| Allowance, March quarter | 62 10 0 | |
| Bill for repairs, &c. | 4 8 1 | |
| | 66 18 1 | |
| Less sundries supplied | 3 14 2 | |
| | | 63 3 11 |
| S. J. Perry, Stonyhurst— | | |
| Allowance, March quarter | 50 0 0 | |
| Postages, &c. „ | 1 13 11 | |
| | 51 13 11 | |
| Less sundries supplied | 3 10 10 | |
| | | 48 3 1 |
| Thos. Kerr, Valencia— | | |
| Salary for March | | 20 16 8 |
| Contingent expenses | | 50 12 2 |
| Standidge & Co, Printing, &c. | | 21 5 0 |
| T. Weeks, Leather Cases | | 1 5 6 |
| Carried forward | | 612 19 9 |

| | £ | s. | d. |
|---|---|---|---|
| Brought forward - - | 612 | 19 | 9 |
| R. W. Munro— | | | |
| Thermometer Tabulating Instruments - - 13 6 0 | | | |
| Alterations to Anemometer intended for Orkney* 0 18 0 | | | |
| | 14 | 4 | 0 |
| Thos. Tiller, Packing Cases - - - - - | 1 | 14 | 6 |
| For Contingencies: | | | |
| C. Clouston, sixmonths' attendance to Anemometer - - | 5 | 0 | 0 |
| Total - - - - - | £633 | 18 | 3 |

The Committee then adjourned.

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2, *Parliament Street, Monday, April* 12, 1869.

PRESENT:

General Sabine in the Chair.

Mr. Spottiswoode. | Mr. Gassiot.

The Director and the Secretary to the Committee were in attendance.

The Minutes of the last meeting were read and confirmed.

Read—Letter from Board of Trade.

*Meteorology.*

Board of Trade, Whitehall Gardens,
8th April 1869.

SIR,

WITH reference to your letter of the 2nd ultimo, enclosing one from the Office of Works relative to the vacating of the rooms at present occupied by the Meteorological Committee, I am directed by the Board of Trade to inform you that the Office of Works, in reply to a letter addressed to them by this department on the 2nd ultimo, state that they cannot continue to accommodate the Committee in their present office, and that they have no other rooms in the neighbourhood which they can let the Committee have.

I am, &c.
THOMAS GRAY.

R. H. Scott, Esq., Meteorological Office.

Mr. Scott was instructed to reply as follows:

Office, 15th April 1869.

SIR,

WITH reference to your letter of the 8th instant (M. 2980), I am instructed by the Committee to inform you that they have intimated to Her Majesty's Office of Works that they will be prepared to vacate the house No. 1, Parliament Street, on the 1st June next.

I am, &c.
ROBERT H. SCOTT, Director.

Thomas Gray, Esq., Assistant Secretary,
Board of Trade.

Also to send the following reply to the Board of Works. (Minutes, p. 19.)

15th April 1869.

SIR,

I AM instructed by the Committee to inform you in reply to your letter of the 24th of February last (1435 A.) that they will be prepared to vacate the house No. 1, Parliament Street, on the 1st June next.

I am, &c.
ROBERT H. SCOTT, Director.

George Russell, Esq., Secretary,
Her Majesty's Office of Works.

Mr. Scott submitted certain particulars of accommodation suitable for the office. He suggested apartments at No. 116, Victoria Street, as best likely to suit, and was authorized to offer to the Westminster Improvement Commissioners a rent of 350*l.* per annum for two floors, containing eight rooms in all.

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* Chargeable to Contingencies.

Read—A letter from Mr. Kerr, Director of the Observatory, Valencia, requesting permission to lay in a stock of paraffine (say from 150 to 200 gallons), as opportunity may serve by the sailing of vessels from London or otherwise.—Permission granted.

Mr. Scott submitted the following statement, pursuant to resolution of Committee, dated August 20, 1868.

ACCOUNTS PAID, AND LIABILITIES TO MARCH 31, 1869.

| | Paid. | Estimated Liabilities. |
|---|---|---|
| | £ s. d. | £ s. d. |
| Salaries | 2,653 2 0 | — — — |
| Instruments, Mercantile Marine | 111 15 2 | 57 7 0 |
| ,, Admiralty | 289 9 7 | 25 0 0 |
| Agencies at Ports | 57 19 6 | 9 10 0 |
| Travelling | 157 7 5 | 10 0 0 |
| Telegraphy | 2,284 2 2 | 239 5 0 |
| Observatories, Current Expenses | 2,014 9 4 | 19 13 0 |
| ,, Outfit | 550 9 10 | 10 0 0 |
| Special Printing | 51 1 2 | 1 0 0 |
| Contingencies | 345 17 9 | 2 5 0 |
| Totals | 8,515 13 11 | 374 0 0 |

Grand total - 8,889*l.* 13*s.* 11*d.*

ROBERT H. SCOTT, Director.

The Committee then adjourned.

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2, *Parliament Street, Monday, April* 19, 1869.

PRESENT:

General Sabine in the Chair.

| | |
|---|---|
| Mr. Galton. | Mr. Spottiswoode. |
| Mr. Gassiot. | Dr. W. A. Miller. |

The Director and the Secretary to the Committee were in attendance.

The Minutes of the last meeting were read and confirmed.

Mr. Scott stated that he had received an imprest for 2,000*l.* from the Treasury (Minutes, April 5), and had lodged it in the Bank of England.

He submitted an agreement for the apartments at No. 116, Victoria Street, at the following rent:—350*l.* for the entire first and Mezzanine floors (eight rooms), 20*l.* for a room on the basement floor, 2*l.* 10*s.* for gas burners on the stairs; in all 372*l.* 10*s.* per annum.

Some modifications to the agreement were suggested, and Mr. Scott was authorized to sign it if the Westminster Improvement Commissioners consented to the insertion of these modifications.

Mr. Gassiot and Mr. Spottiswoode consented to act as a sub-committee to superintend the fittings and furniture of the new office.

A special meeting of Committee was ordered to be summoned for Wednesday, the 21st instant, at the office, to consider the position of the office with regard to the Royal Society.

The Secretary presented the following report regarding the records for March 1869, received from the self-recording instruments from the various observatories, and which have been examined at Kew in accordance with the regulations adopted by the Meteorological Committee. (See Minutes, 21st December 1868.)

## Anemograph.

*Aberdeen.*—The anemograph of this station has been in good action during this month. The records are quite complete. The orientation was tested on March 30th and found correct. No error in tabulation has been discovered at Kew. Forty remeasurements of direction and velocity have been made with the following results:

| | Direction. | | Velocity. |
|---|---|---|---|
| (1.) Greatest difference - - | 1·0 | - - - | 2·0 |
| (2.) Mean difference irrespective of sign | 0·1 | - - - | 0·5 |
| (3.) Residual difference - - | +0·1 | (Aberdeen−Kew) | −0·1 |

*Armagh* (January).—This month's results have been examined at Kew according to a method which has been decided upon after consulting with Dr. Robinson.

*Falmouth.*—On Friday, 19th March, one of the cups of the anemograph was blown off through the violence of the wind, and the instrument continued in action with three cups until March 24th, 11 a.m., when it was repaired. In consequence of this accident, 25 hourly records of velocity and one of direction have been lost, in other respects the action of the instrument has been good, and the records are otherwise complete.

The orientation was tested on April 8th and found correct. No error in tabulation has been discovered at Kew.

Forty remeasurements have been made with the following results:

| | Direction. | | Velocity. |
|---|---|---|---|
| (1.) Greatest difference - - | 1·0 | - - - | 2·0 |
| (2.) Mean difference irrespective of sign | 0·1 | - - - | 0·8 |
| (3.) Residual difference - - | 0·0 | (Falmouth−Kew) | +0·4 |

*Glasgow.*—The anemograph at this station has been in good action during this month, and the records are quite complete. No errors of tabulation have been discovered at Kew. Forty remeasurements have been made with the following results:

| | Direction. | | Velocity. |
|---|---|---|---|
| (1.) Greatest difference - - | 1·0 | - - - | 3·0 |
| (2.) Mean difference irrespective of sign | 0·2 | - - - | 0·9 |
| (3.) Residual difference - - | 0·0 | (Glasgow−Kew) | +0·3 |

*Kew.*—The anemograph at this station has been in good action during this month, and the records are complete, with the exception of one hourly record of velocity which was lost in consequence of the orientation being tested on March 10th. No error of tabulation has been discovered. Forty remeasurements have been made with the following results:

| | Direction. | | Velocity. |
|---|---|---|---|
| (1.) Greatest difference - - | 0·0 | - - - | 2·0 |
| (2.) Mean difference irrespective of sign | 0·0 | - - - | 0·4 |
| (3.) Residual difference - - | 0·0 | ($Kew^1$−$Kew^2$) | +0·2 |

*Stonyhurst.*—The anemograph at this station has been in good action during this month and the records are complete. The orientation was tested March 23rd and found correct. No error of consequence has been discovered in tabulation at Kew.

Forty remeasurements have been made with the following results:

| | Direction. | | Velocity. |
|---|---|---|---|
| (1.) Greatest difference - - | 1·0 | - - - | 2·0 |
| (2.) Mean difference irrespective of sign | 0·0 | - - - | 0·6 |
| (3.) Residual difference - - | 0·0 | (Stonyhurst−Kew) | +0·1 |

*Valencia.*—The anemograph has been in good action during the month, and the records are complete. The orientation was tested March 8th and found correct. No error of consequence has been discovered at Kew in the tabulation.

Forty remeasurements have been made at Kew with the following results:

| | Direction. | | Velocity. |
|---|---|---|---|
| (1.) Greatest difference - - | 1·0 | - - - | 3·0 |
| (2.) Mean difference irrespective of sign | 0·1 | - - - | 0·6 |
| (3.) Residual difference - - | −0·1 | (Valencia−Kew) | +0·2 |

## Barograph.

*Aberdeen.*—The action of the barograph, as well as the photography, have been good during the month, the records are complete.

The following errors in applying the residual correction have been discovered and put right:

March 3, 7 p.m., 29·860 should be 29·855
27, 8 p.m., 29·606 „ 29·607

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference - - - - | 0·006 |
| (2.) Mean difference irrespective of sign - - | 0·0024 |
| (3.) Residual difference (Aberdeen−Kew) - - | −0·0002 |

The mean monthly difference between simultaneous standard and tabulated readings is 0·0019.

*Armagh.*—The action of the barograph for the month of March, as well as the photography, have been very good, except that there is still a bending in the curves, which shows itself at the commence-

ment of each sheet. On the 24th March, Mr. Beckley, mechanical assistant at the Kew Observatory, visited Armagh in order to investigate, in conjunction with Dr. Robinson, the cause of this bending; the attempts to overcome the bending have not yet resulted in success, but it is hoped they will finally succeed. In consequence of these experiments the hourly records for five days and twenty-three hours have been lost, but sixteen observations of the standard barometer have been made during the interval. Besides this three hourly records were lost on the 2d March in consequence of the cylinder being fitted with new clips. In all six days and two hours records have been lost.

In calculating the residual correction for this month there seems to have been some misapprehension regarding the new plan which was resolved upon. Certain alterations have in consequence been made at Kew.

Forty remeasurements have been made at Kew with the following results:

(1.) Greatest difference - - - ·007
(2.) Mean difference irrespective of sign - ·0021
(3.) Residual difference - - - ·000 (Armagh — Kew)

The mean monthly difference between simultaneous standard and tabulated readings is 0·0019.

*Falmouth.*—The action of the barograph for the month of March, as well as the photography, have been good, but the hourly record for March 20, 11 a.m., has been lost in consequence of a photographic blemish.

The following errors have been discovered and put right:

In entry of standard readings—

March 10, 8 a.m., 29·743 should be 29·143
16, 10 a.m., 29·464 „ 29·564
18, 10 a.m., 29·661 „ 29·771

Forty remeasurements have been made at Kew with the following results:

(1.) Greatest difference - - - - - ·006
(2.) Mean difference irrespective of sign - - ·0025
(3.) Residual difference (Falmouth—Kew) - - +·0007

*Glasgow.*—The action of the barograph for the month of March, as well as the photography, have been good, and the records are complete.

The following errors have been discovered and corrected:

In entry of standard reading—

March 31, mid., 29·738 should be 29·838

In application of residual correction—

March 15, noon, 29·708 should be 29·709

Forty remeasurements have been made at Kew with the following results:

(1.) Greatest difference - - - - - ·006
(2.) Mean difference irrespective of sign - - ·0026
(3.) Residual difference (Glasgow—Kew) - —·0008

The mean monthly difference between simultaneous standard and tabulated readings is 0·0026.

*Kew.*—The action of the barograph for the month of March, as well as the photography, have been good, and the records are complete.

The following errors have been discovered and put right:

In application of residual correction—

March 5, 11 p.m., 29·894 should be 29·890
„ 9, 4 p.m., 29·449 „ 29·454
„ 18, 8 a.m., 29·907 „ 29·906
„ 24, 10 a.m., 30·196 „ 30·199
„ „ 11 a.m., 30·085 „ 30·185
„ „ noon, 30·065 „ 30·165
„ „ 1 p.m., 30·045 „ 30·145
„ 25, 11 a.m., 30·086 „ 30·085

Forty remeasurements have been made with the following results:

(1.) Greatest difference - - - - ·005
(2.) Mean difference irrespective of sign - - ·0018
(3.) Residual difference ($Kew^1 - Kew^2$) - - —·0007

The mean monthly difference between simultaneous standard and tabulated readings is 0·0023.

*Stonyhurst.*—The action of the barograph for the month of March is good. The photography is also good, but there is occasionally a want of light for the temperature curve. Monthly records complete.

The following errors have been discovered and put right:

In entry of standard readings—

March 22, 10 p.m., 29·818 should be 29·918

In application of residual correction—

March 1st, mid. 28·723 should be 28·727
„ 2nd, 2 a.m., 28·815 „ 28·715
„ 12th, 6 a.m., 29·312 „ 29·313
„ 28th, 11 a.m., 29·271 „ 29·270

Forty remeasurements have been made with the following results:

| | |
|---|---|
| (1.) Greatest difference | ·006 |
| (2.) Mean difference irrespective of sign | ·0018 |
| (3.) Residual difference (Stonyhurst—Kew) | +·0001 |

The mean monthly difference between simultaneous standard and tabulated readings is 0·0024.

*Valencia* (February).—The action of the barograph for the month of February is good, and also the photography. Monthly records complete.

The following errors have been discovered and put right:

In entry of standard readings—

February 24th 4 p.m. 30·015 should be 30·115
„ „ 10 p.m. 30·016 „ 30·216

In application of the residual correction—

| | | | | |
|---|---|---|---|---|
| February 1st, | mid. | 29·486 | should be | 29·485 |
| „ 4th, | 4 p.m. | ·764 | „ | ·784 |
| „ 7th, | mid. | ·426 | „ | ·424 |
| „ 7th, | 10 a.m., | ·778 | „ | ·678 |

And 30 similar instances.

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | ·007 |
| (2.) Mean difference irrespective of sign | ·0026 |
| (3.) Residual difference (Valencia—Kew) | +·0003 |

The mean monthly difference between simultaneous standard and tabulated readings is 0·0031.

*Valencia* (March).—The action of barograph for the month of March is good, also the photography good. Monthly records complete.

The following errors detected and put right:

In entry of standard readings—

March 1st, 10 a.m. 29·953 should be 29·853
„ 12th, 4 p.m. 29·453 „ 29·353
„ 13th, 4 p.m. 29·425 „ 29·525

In applying residual correction—

March 1st, 9 a.m. 29·872 should be 29·882
„ 12th, 3 a.m. 29·775 „ 29·785
„ 13th, 5 a.m. 29·238 „ 29·237

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | ·007 |
| (2.) Mean difference irrespective of sign | ·0025 |
| (3.) Residual difference (Valencia—Kew) | +·0012 |

The mean monthly difference between simultaneous standard and tabulated readings is 0·0030.

## Thermograph.

*Aberdeen.*—The Aberdeen thermograph has been in good action during the month of March, and the photography has been good. The hourly records for the dry bulb are complete, with the exception of the four hours from 4 to 8 a.m. of March 30th when the gas was too low. Five hourly records of the wet bulb were lost from the same cause, also the hourly record of the wet bulb for March 13th, 9 a.m., was lost on account of water being added. And also two hourly records of the wet bulb from 6 to 7 p.m. of March 29th, were lost through a photographic blemish. 41 hourly records of the same instrument have been lost through the unavoidable action of frost.

The following errors have been detected and put right:

Two slight errors in maxima and minima, and a few slight alterations made in some of the tabulated numbers.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| Greatest difference | 0·3 | 0·3 |
| Mean difference irrespective of sign | 0·14 | 0·15 |
| Residual difference (Aberdeen—Kew) | —0·05 | —0·04 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| ·12 | ·13 |

*Armagh.*—The Armagh thermograph has been in good action during the month of March, and the photography has been very good. The records for the dry bulb are quite complete. Thirty-one hourly records of the wet-bulb have been lost through the unavoidable action of frost, but these records are otherwise complete. A few slight errors in maxima and minima have been detected, and a few wet-bulb tabulations have been re-made at Kew.

Forty remeasurements have been made at Kew with the following result:

| | Dry. | Wet. |
|---|---|---|
| Greatest difference | 0·3 | 0·3 |
| Mean difference irrespective of sign | 0·11 | 0·09 |
| Residual difference (Armagh—Kew) | —0·04 | +0·05 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| ·15 | ·15 |

*Falmouth.*—The Falmouth thermograph has been in good action during March, and the photography has been good. The records for the dry bulb are complete with the exception of three hours from 11 a.m. to 1 p.m. of March 24th, which have been lost through an error in starting the cylinder, the same hours have been lost for the wet bulb, in addition to which one hourly record has been lost through the unavoidable action of frost. Two slight errors in maxima and minima have been detected, and the wet-bulb standard reading entered on March 15th, 10 a.m., as 34·2 should be 33·2.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign - - | 0·14 | 0·12 |
| (3.) Residual difference (Falmouth—Kew) - - | 0·05 | +0·02 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·08 | 0·09 |

*Glasgow.*—The instrument has been in good action during March, and the photography has been good. The records for the dry bulb are quite complete. Fifty-eight hourly records of the wet bulb have been lost through the unavoidable action of frost. In consequence of an erroneous setting of the scale, the wet-bulb records, from March 1st 1 a.m. to March 2d 10 a.m., were retabulated at Kew.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign - - | 0·19 | 0·12 |
| (3.) Residual difference (Glasgow—Kew) - - | —0·09 | —0·04 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·11 | 0·11 |

*Kew.*—The instrument has been in good action during March. The photography has also been good, but there is a little discoloration in the sheets, the cause of which has not been discovered. The dry bulb records are complete, but 31 hourly records of the wet bulb have been lost through the unavoidable action of frost. No errors have been discovered.

Forty remeasurements have been made with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - - | 0·2 | 0·2 |
| (2.) Mean difference irrespective of sign - - - | 0·06 | 0·08 |
| (3.) Residual difference ($Kew^1$—$Kew^2$) - - | —0·04 | + 0·03 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·05 | 0·06 |

*Stonyhurst.*—The instrument has been in good action during March, and the photography is also good. The records of the dry bulb are quite complete, but 48 hourly records of the wet bulb have been lost through the unavoidable action of frost. One or two slight errors have been detected in the maxima and minima; no further errors have been discovered.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - - | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign - - - | 0·11 | 0·12 |
| (3.) Residual difference (Stonyhurst—Kew) - - | 0·0 | 0·0 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·10 | 0·13 |

*Valencia.*—The instrument has been in good action during March, and the photography has also been good. Seven hourly records of the dry bulb, from 3 to 9 a.m. of March 10th, have been lost through the curve being indistinct. The records for the wet bulb are quite complete. On several occasions the standards appear to have been erroneously read; this led, on two occasions, to an erroneous setting of the scale, which was detected at Kew.

The following errors in tabulation have been detected by remeasurement at Kew:

| | | | | | |
|---|---|---|---|---|---|
| Wet bulb, | March | 2d, | 2 p.m., | 43·5, should be | 44·0 |
| „ | „ | „ | 8 p.m., | 39·3, „ | 40·1 |
| „ | „ | 4th, | 4 p.m., | 48·0, „ | 48·4 |
| „ | „ | 6th, | 2 p.m., | 42·5, „ | 42·7 |
| Dry bulb | „ | 8th, | 7 p.m., | 41·2, „ | 42·0 |
| „ | „ | 12th, | 9 a.m., | 48·7, „ | 39·0 |
| „ | „ | „ | 10 a.m., | 48·4, „ | 38·7 |
| Wet bulb | „ | 7th, | 5 p.m., | 44·5, „ | 45·2 |
| „ | „ | „ | 7 p.m., | 42·0, „ | 42·7 |
| „ | „ | 12th, | noon, | 38·8, „ | 38·5 |
| „ | „ | „ | 2 p.m., | 42·0, „ | 41·7 |
| „ | „ | 13th, | 4 p.m., | 30·0, „ | 40·0 |

Several errors of maxima and minima have been detected and put right.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - - | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign - - - | 0·12 | 0·17 |
| (3.) Residual difference (Valencia—Kew) - - | —0·10 | 0·0 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| ·14 | ·16 |

In the following table the number of hourly records lost during the month of March is exhibited:

| | Anemograph. | | Barograph. | Thermograph. | | |
|---|---|---|---|---|---|---|
| | | | | Dry. | Wet. | |
| | Direction. | Velocity. | | | Frost. | Other Causes. |
| Aberdeen - - - | 0 | 0 | 0 | 4 | 41 | 8 |
| Armagh - - - | — | — | *146 | 0 | 31 | 0 |
| Falmouth - - - | 1 | †25 | 1 | 3 | 1 | 3 |
| Glasgow - - - | 0 | 0 | 0 | 0 | 58 | 0 |
| Kew - - - - | 0 | 1 | 0 | 0 | 31 | 0 |
| Stonyhurst - - - | 0 | 0 | 0 | 0 | 48 | 0 |
| Valencia - - - | 0 | 0 | 0 | 7 | 0 | 0 |
| Valencia (February) - | — | — | 0 | — | — | — |

* Unavoidably lost through experiments connected with the bending of the barograph curve.

† Unavoidably lost, the instrument being under repair in consequence of a cup having been blown away through the violence of the wind.

The Committee then adjourned.

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## (SPECIAL MEETING.)

2 *Parliament Street, Wednesday, April* 21, 1869.

PRESENT:

General Sabine in the Chair.

Mr. Gassiot.
Mr. De la Rue.
Mr. Spottiswoode.
Mr. Galton.
The Hydrographer.
Dr. W. A. Miller.

The Director was in attendance, and submitted the following draft of a letter addressed to the Secretary of the Board of Trade, which was approved:—

SIR,

Meteorological Office, April 1869.

INASMUCH as some misconception in the public mind appears to have arisen with reference to the relations of this office to the Royal Society on the one hand, and to the Board of Trade on the other, I am instructed by the Committee to address a letter to you with the view of placing on record the leading facts connected with the original establishment of the office by the Government, and its present management by the Meteorological Committee of the Royal Society.

In the year 1853 the question of establishing a uniform system of Meteorological Observations on land, under Government auspices, was first mooted, and it originated (at the suggestion of Sir J. Burgoyne) between the Government of this country and the United States. The latter desired to include in the scheme observations at sea, a subject on which Lieutenant Maury had been for some time successfully engaged, with the view of ascertaining the most advantageous routes for making ocean passages; and the United States Government suggested that the different maritime nations should be invited to join in the proposal.

The Government submitted the question to the Royal Society, and it was decided, in concert with America, to postpone for the present the attempt to reduce to a uniform system the land observations then making by the different nations on the Continent of Europe.

Subsequently in 1853 a conference of the maritime nations, known as the Brussels Conference, met at Brussels, and it was there decided that owing to the great want of uniformity of scales and instruments, it would be impossible, until this difficulty was got over, to undertake one of the objects, viz., the land meteorology, but it was strongly recommended at once to remove the difficulty. At this Conference

it was resolved that a uniform scheme should be adopted for the prosecution of the study of marine meteorology.

Out of this Conference resulted, in 1855, the Meteorological Department of the Board of Trade, which was established by Mr. Cardwell and placed under the direction of Admiral FitzRoy, and the Royal Society were asked to give advice as to the branches of meteorology to which the Department should direct its attention. Their suggestions will be found at p. 5 of the report of a Government committee which sat to inquire into the whole subject in the year 1866, and they related chiefly to ocean meteorology and to observations at certain foreign outlying stations where we had military garrisons.

Thus it will be seen that a meteorological service under the auspices and in the pay of Government has been in existence since 1855, and its annual cost during the first 10 years varied between about 3,000*l.* and 7,000*l.* With the advice given by the Royal Society in 1855 may be said to have ended its connexion with the undertaking until the death of Admiral FitzRoy ten years later. In the meantime Admiral FitzRoy had commenced the duties of the Department, issued vast numbers of instruments to ships of war and merchant vessels, and worked for some years in concert with Lieut. Maury. An enormous amount of data, much of it of great value, was accumulated during these years, but the work of reduction and discussion of these materials was very far from keeping pace with their collection, so that not much was effected in the way of constructing practical physical charts for the use of seamen, which indeed could scarcely have been expected from the Department as it was then constituted.

However, for some years before Admiral FitzRoy's death his attention and that of his Department appears to have been gradually diverted to a wholly different branch of meteorology, viz., the prognostication of weather, and probably fearing a still greater accumulation of ocean data than the Department could deal with, he checked to a great extent the collection of materials and turned his own attention mainly and almost exclusively to the forecasting of storms.

To enable the office to carry out these new views, barometers, &c., were placed at numerous stations round the coasts of the United Kingdom, and observations telegraphed from them to the central office in London, whence the warnings were then issued.

It is only proper to say that, so far as is known, the grounds on which these predictions were founded were not reduced to rules; at least none have been left on record, though of course the superintendent was guided by some principles which he communicated to his deputy when he was unable personally to attend to this special line of duty.

It is only correct also to state that there was no kind of supervision over the observers on the coasts, or over the position and condition of the instruments, yet under all these disadvantages the storm warnings and weather forecasts became most popular among the seafaring population, and abundance of testimony has been advanced as to its value in the saving of life and property.

It appears from the foregoing that the office was originally under the control of one individual, and although the department of the Government under which it was placed, viz., the Board of Trade, appeared to have entertained doubts as to whether the system pursued was that most to be desired, they do not seem to have felt themselves justified in interfering with the action of the officer at its head, nor did they do so beyond again consulting the Royal Society on the subject in 1863.

In their reply, the President and Council stated that they considered the objects for which the institution had been established in 1855 were still as important in 1863 as they had been at the former period. Things, however, remained as they were for 10 years, when on the death of Admiral FitzRoy in 1865 the Board of Trade again put themselves in communication with the Royal Society, on the subject of a reconstruction of the department, should such a step appear necessary.

The result of this communication was the appointment of a committee of three gentlemen, at the suggestion of the Board of Trade. These gentlemen were nominated respectively by the Board of Trade, the Admiralty, and Royal Society, and they conducted a searching examination into the working of the office, and presented their report to Parliament in 1866.

The recommendations contained in this report were briefly:—

I. The resumption of the collection of ocean statistics.

II. The issue of storm warnings on an improved principle.

III. The establishment of fixed meteorological observatories, furnished with self-recording instruments at convenient stations round the coasts, with the view of joining in the general investigation of land meteorology in concert with the continental nations of Europe.*

IV. The placing of the office under efficient scientific supervision.

The recommendations contained in this report were approved by the Government, and the Royal Society were requested to undertake the management of the office.

The President and Council in their reply consented to accept the trust, and to carry out the recommendations of the Committee of Inquiry, with the exception of No. II., as will be herein-after explained. The Committee of the office was then appointed, and it consists of eight gentlemen, Fellows of the Royal Society, and versed in the science of meteorology. The Committee at once proceeded to appoint a competent staff of officers and clerks.

It may seem scarcely necessary to state, that the Royal Society, further than having at the request of the Government nominated the superintending Committee, and retained the right of filling up

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* Almost all of these countries, viz., France, Prussia, Austria, Russia, Holland, Belgium, Sweden, Norway, Italy, Switzerland, and Turkey have possessed, many of them for a long time, establishments of a somewhat similar character, to which those of this country, from its geographical position and its exceptional climate, would prove a most valuable addition, and would afford means for a thorough investigation of the laws which govern the winds and other atmospherical phenomena; a subject of such vital importance not only to the seaman, but to every other class of the population of these islands.

vacancies in that Committee, should such occur, is in no way connected with the Meteorological Office, nor is in any sense pecuniarily interested in the grant made to it. It should also be stated that the Committee give their services gratuitously. When it is considered that they meet regularly every week, and have frequently additional work connected with the office imposed upon them, and moreover, that they are all men whose other occupations are constant and unremitting, it will probably be admitted that their position is not one of a merely nominal nature. No allusion would have been made to these circumstances were it not that, from observations which have appeared in print, it might have been inferred that the facts had been otherwise.

Since the Committee commenced their duties in January 1867, they have steadily pursued the two great objects which they undertook, viz., ocean and land meteorology, and a third, viz., weather telegraphy, was soon added to their labours.

When the President and Council of the Royal Society declined to entertain the proposal that the Committee should undertake to send out storm warnings, and recommended that that branch should still be conducted, if at all, under the management of the Board of Trade, the issue of these warnings was suspended by the Board of Trade at the end of 1866. The grounds assigned for this refusal were that the system did not rest on a sound scientific basis, and that accordingly, until such had been established, the issue of the warnings could not be undertaken by a strictly scientific body.

The public demand for the information was, however, so strongly expressed and reiterated in Parliament, that the Committee consented, at the request of the Board of Trade, to modify their views so far as to give notice by telegram of the actual state of the weather on any one part of the coast to other parts. Before this system could be established, it was necessary that a thorough examination into the condition and position of the reporting stations should be carried out, and they were all inspected in the course of the autumn of 1867. The present system was commenced in January 1868. At the present time after a lapse of two years from their taking charge of the office, they have been led by a careful investigation of facts to commence the laying down of rules by which approaching storms may be anticipated.

It will not be here attempted to give more than a very brief account of the progress which the Committee have made since they entered upon their duties.

In regard to ocean meteorology, the issue of instruments has been resumed and every effort has been made to enlist the services of the most intelligent commanders of merchant ships. Many of our leading steamship companies have consented to co-operate in the work of collection. By these means valuable observations are being obtained over areas for which but little information previously existed. The vast arrears of registers existing in the office are also in process of discussion with a view to the construction of physical charts, and it is in contemplation to produce such charts, exhibiting the various meteorological phenomena for each month and for each square degree over the entire surface of the sea, should such minuteness be found desirable.

The materials collected by Admiral FitzRoy have already contributed towards the construction of the pilot charts for the Atlantic Ocean, lately published by the Admiralty,—the importance of which to seamen cannot be overrated. A similar series of charts, for the Indian and Pacific oceans, are in process of compilation, and the data already collected or in process of collection by the office continues to be furnished to the Admiralty for embodiment in these publications.

In regard to land meteorology, seven observatories fitted with the most improved self-recording instruments for the registry of barometrical pressure, temperature, moisture, and of wind, have been established at convenient points, viz., two in Scotland, at the Universities of Aberdeen and Glasgow; two in Ireland, at the Observatory of Armagh and on the island of Valencia; and three in England, at the College of Stonyhurst, the Royal Polytechnic Institution of Cornwall at Falmouth, and, at the Central and Normal Observatory, the Observatory of the British Association at Kew, where the records from all the other observatories are examined before being sent on to the central office in London for discussion.

These observatories have been for some months in working order, and the discussion of the materials furnished by them is now being commenced.

As regards the communication of telegraphic weather intelligence, daily telegraphic messages are received from 17 British coast stations and from 13 continental stations, containing reports of the instrumental readings and of the state of the weather, and in addition afternoon reports are transmitted from six stations. From these materials a daily weather chart is constructed, and telegraphic information of the weather, as it exists, is sent, whenever a serious disturbance is reported, to 100 stations on the coasts of these islands, and also to the entire coast of the continent between Norway and Spain (in return for the daily intelligence received from these countries).

It will be seen from the foregoing that the system of weather telegraphy is most intimately connected with the observations of land meteorology conducted by the Committee, and that the one could not be given without possessing accurate knowledge of the other.

The entire work of the office is of a strictly national character, and such as is conducted in other countries under the auspices of the respective governments.

The whole of the funds by means of which it is carried on are supplied by Parliament. It could not be expected that operations of so comprehensive a nature and of purely national interest could be conducted by any private society.

T. H. Farrer, Esq., Secretary, Board of Trade.

The Committee then adjourned.

2, *Parliament Street, Monday, April* 26, 1869.

PRESENT:

General Sabine in the Chair.

Mr. Spottiswoode. | Mr. Gassiot.

Dr. W. A. Miller.

The Director and the Secretary to the Committee were in attendance.

The Minutes of the last two meetings were read and confirmed.

Mr. Scott reported that the letter to the Board of Trade adopted at the special meeting on the 21st inst. had been forwarded.

Mr. Scott submitted the following list of instruments and old material, now in store, but of no service to the office:—

21 Barometers:
Hicks (no number), long range, without cistern, has never been of any use.
Negretti, † 178, broken brass frame.
Adie, A 360, part of brass frame only, and in bad condition.
Negretti, wood frame, not numbered, good, but dirty.
Spencer & Browning, old wood frame.
Ciceri & Pini, good but dirty.
Jones, old wood frame, tube defective, no arm.
Thomas Jones, wood frame, tube good, no arm.
Charlet, very old wood frame, tube defective.
Newman, no number, wood frame, good, but wants cleaning up.
Newman, ditto, ditto.
Newman, † M 13, wood frame, good, but wants cleaning up.
Newman, † No. 42, wood frame, good, slight repairs wanted.
Dennis, † wood frame, tube not contracted, mercury oxidized, no arm.
Dennis, † 60, wood frame, dirty, tube broken.
Dennis, † 63, wood frame, damaged, dirty.
West, † 7, wood frame, dirty, tube good.
Bate, † 39, wood frame, dirty, tube defective.
Bate, † 52, wood frame, dirty, tube good.
Bate, † 56, wood frame, dirty, tube good.
Elliott, 6 (mountain), brass frame good, but tube and thermometer broken, case unserviceable.
2 Aneroids, 16,237 and Z 73, broken up, parts lost, not worth repair.
Parts of another Aneroid, number not known.
A ⊥ shaped Clinometer, by Corninck, defective, has been lying by for years.
2 Cup-and-dial Anemometers—Casella, † A 9, in case, broken up; Adie (no number), broken up.
3 Azimuth compasses, B. T. 14, 83, 124, broken up, part lost.
20 Rain gauges, 10 copper, 10 zinc, in battered condition, pattern discarded.
8 Camphor glasses, old and not required here.
6 Thermometers, unsuitable in kind, and unserviceable in condition; two by Bradburn, two by Newman, two by Vohl.
1 Minimum thermometer, Negretti, 305, useless.
1 Johnson's metallic deep-sea thermometer, † 5, broken up, parts corroded.
34 Brass hydrometers—nine in boxes and four without, by Adie; 16 by Casella; five by Negretti. Two of these hydrometers are broken, four are very much corroded; the rest are in good condition, but are not now required for service.
64 Brass thermometer scales, weight 13 lbs.; also 8 lbs. of old scrap brass.
34 Zinc thermometer scales, weight 12 lbs.; also 1 lb. of old scrap zinc.
3 Deep-sea thermometer cases, old copper, weight $8\frac{3}{4}$ lbs.; also $4\frac{1}{2}$ lbs. of old scrap copper.
17 Small horse-shoe magnets, useless.
38 Box-wood cisterns from barometers.
27 Wood mounts for thermometers.
2 Thermometer screens, not repairable.

Resolved—That these articles be sold.

He also requested permission to have a spare Milne's self-registering barometer, now in the office, repaired, with the view of having it erected at Yarmouth.

Resolved—That this be authorized, provided the cost do not exceed 7*l.*

Mr. Gassiot suggested that it was advisable that a comparison should be instituted in the office between the weather recorded by the self-registering instruments and the telegraphic weather intelligence issued by the office.

Resolved—That this suggestion be carried out.

Mr. Scott submitted the name of Mr. John Curtis as a candidate for a temporary clerkship (Minutes, p. 29), at a salary of 25*s.* per week.

Mr. Curtis was accordingly appointed.

The following cheques were drawn:—

| | £ | *s.* | *d.* |
|---|---|---|---|
| For salaries for April:— | | | |
| R. H. Scott | 66 | 13 | 4 |
| H. Toynbee | 33 | 6 | 8 |
| B. Stewart | 33 | 6 | 8 |
| W. Salmon | 18 | 6 | 8 |
| J. S. Harding, jun. | 14 | 3 | 4 |
| R. Strachan | *16 | 13 | 4 |
| S. Jeffery | †12 | 0 | 0 |
| F. Gaster | 10 | 16 | 8 |
| C. Harding | 9 | 3 | 4 |
| R. H. Curtis | 7 | 10 | 0 |
| F. Steventon | 6 | 13 | 4 |
| J. S. Harding, sen. | †7 | 14 | 0 |
| E. Magrath | ‡6 | 5 | 0 |
| A. D. Spencer | §3 | 15 | 0 |
| G. Francis | ‡3 | 15 | 0 |
| G. Brodie | §2 | 5 | 0 |
| For Agencies:— | | | |
| J. Gardner, Greenock | 2 | 10 | 0 |
| J. R. Jones, Aberdeen | 6 | 5 | 3 |
| For Telegraphy:— | | | |
| Electric Telegraph Company — March account 98 16 10; Special charges for February 20 7 6 | 119 | 4 | 4 |
| Magnetic „ „ March account | 57 | 18 | 3 |
| Submarine „ „ „ „ | 35 | 12 | 10 |
| For Expenses at Observatories:— | | | |
| T. Kerr, salary for April | 20 | 16 | 8 |
| Outfit of Observatories:— | | | |
| B. Stewart. J. Long's account for fittings at Kew | 8 | 14 | 0 |
| For Contingencies, Books, &c.:— | | | |
| J. D. Potter, books | 25 | 0 | 0 |
| Harvey & Co., towels, &c. | 3 | 18 | 7 |
| E. Stanford, newspapers | 2 | 4 | 11 |
| H.M. Paymaster-General, presses from Board of Works | 111 | 8 | 0 |
| Office, Petty Expenses:— | | | |
| J. S. Harding, jun., on account | 25 | 0 | 0 |
| | £671 | 0 | 2 |

* Including allowance for care of instruments.
† Four weeks, to 28th instant.
‡ Five ditto, to 1st May.
§ Three ditto to 1st May.

The Committee then adjourned.

2, *Parliament Street, Monday, May* 3, 1869.

PRESENT :

General Sabine in the Chair.

| | |
|---|---|
| Mr. Galton. | Dr. W. A. Miller. |
| Mr. Gassiot. | Mr. Spottiswoode. |

The Director and the Secretary to the Committee were in attendance.

The Minutes of the last meeting were read and confirmed.

The Auditors presented the following Report, which was received and ordered to be entered on the Minutes.

METEOROLOGICAL OFFICE REVENUE AND EXPENDITURE ACCOUNT for the year ended March 31, 1869.

| Dr. *Revenue.* | £ | s. | d. |
|---|---|---|---|
| To Parliamentary vote | 10,000 | 0 | 0 |
| Balance from year 1867–68 | 12 | 4 | 0 |
| J. Balbirnie | 4 | 5 | 0 |
| G. Dornbusch | 10 | 0 | 0 |
| Sale of signal staffs | 4 | 8 | 3 |
| W. W. Rundell | 6 | 7 | 3 |
| India Office | 172 | 2 | 8 |
| S. W. Hodding | 3 | 10 | 0 |
| Captain Otter, R.N. | 0 | 15 | 0 |
| Interest on deposit account | 45 | 13 | 0 |
| | £10,259 | 5 | 2 |

| *Expenditure.* Cr. | £ | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|---|
| By Salaries | 2,653 | 2 | 0 | | | |
| Instruments | 111 | 15 | 2 | | | |
| Do. (Admiralty) | 289 | 9 | 7 | | | |
| Agencies at ports | 57 | 19 | 6 | | | |
| Travelling expenses | 157 | 7 | 5 | | | |
| Telegraphy | 2,284 | 2 | 2 | | | |
| Observatories, expenses | 2,014 | 9 | 4 | | | |
| Do. outfit | 550 | 9 | 10 | | | |
| Contingencies (printing &c.) | 396 | 18 | 11 | | | |
| | | | | 8,515 | 13 | 11 |
| Cash in hand | 23 | 2 | 5 | | | |
| Advance to Valencia Observatory | 50 | 0 | 0 | | | |
| Bank of England account | 124 | 15 | 10 | | | |
| London & Westminster Bank | 1,545 | 13 | 0 | | | |
| Balance | | | | 1,743 | 11 | 3 |
| | | | | £10,259 | 5 | 2 |

Examined and compared with the vouchers and found correct.

27th April 1869.

J. P. GASSIOT
W. SPOTTISWOODE } Auditors.

STATEMENT showing BALANCE on April 1, 1869, and an estimated amount of LIABILITIES payable from the same.

| | £ | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|---|
| Balance on 1 April | | | | 1,743 | 0 | 0 |
| Instruments and verifications | 57 | 0 | 0 | | | |
| Do. (Admiralty) | 25 | 0 | 0 | | | |
| Agencies at ports | 9 | 0 | 0 | | | |
| Travelling expenses | 10 | 0 | 0 | | | |
| Telegraphy | 240 | 0 | 0 | | | |
| Observatories | 40 | 0 | 0 | | | |
| Contingencies, &c. | 3 | 0 | 0 | | | |
| Other charges :— | | | | | | |
| Extra Pacific work | 50 | 0 | 0 | | | |
| Observations for Mr. Le Verrier | 15 | 0 | 0 | | | |
| Two anemometers | 150 | 0 | 0 | | | |
| Erection, &c. of ditto | 50 | 0 | 0 | | | |
| Fittings for new office. Presses, Board of Works | 111 | 0 | 0 | | | |
| Furniture | 200 | 0 | 0 | | | |
| Carpets, matting, &c. | 100 | 0 | 0 | | | |
| Carpenters' work | 200 | 0 | 0 | | | |
| Gas work | 50 | 0 | 0 | | | |
| | | | | 1,310 | 0 | 0 |
| Leaving a probable surplus of | | | | £433 | 0 | 0 |

The Director submitted the agreement for the house No. 116, Victoria Street, which had been modified as suggested by the Committee (Minutes, April 9), and which had accordingly been executed.

Read—A letter from Capt. Richards approving of the "Directions for the Examination of Registers," proposed by Capt. Toynbee.

Resolved—That these directions be printed on the Minutes.

## Directions as to how a Log should be examined to discover whether it is worth extracting for the part of the Atlantic at present under investigation.

1st. Notice if the barometer has a daily range in the tropics by going through that part of the log between 20 N. and 10 S., and mentally subtracting the 4 a.m. from the 10 a.m. and the 4 p.m. from the 10 p.m. entries, marking any entry with a query which looks doubtful.

2ndly. Find out if you have the instrumental errors. On the answers to these two queries the question of extraction would very much depend.

3rdly. Discover if the D.R. longitude is brought on from the previous day's longitude by *observation*, or from the last land seen. Then when the positions by observation and D.R. are given, endeavour to discover whether their difference has been used to calculate any currents which may be entered. On these facts rest the decision whether the currents may or may not be calculated.

4thly. Endeavour to discover if the sea temperatures are correct by seeing if there be a cold entry at about 20° N. and 20° W., and if in July, August, or September, the water is colder on or very near the equator than on each side of it. Also if in the neighbourhood of 35° or 40° South and the meridian of Greenwich the sea is cold, and in the same latitude between 20° and 25° East suddenly much warmer. Also if sudden changes from hot to cold, and *vice versâ*, occur in these latitudes to the eastward of Africa, as also in about 40° S. and 50° W., and again in about 50° S. and 50° W.

5thly. Consider the entries of variation. If the ship be wood, notice if they range with the Admiralty variation chart so as to be worth extracting, or if the extreme goodness of the log gives them such weight as to make them worthy of extraction independent of the chart. One fact is to be borne in mind, viz., that the variation in the *ordinary route* across the equator, as given by the Admiralty chart, is so well borne out by numerous good observations, and wooden ships are so liable to deviation, that *in this route* good observations can hardly differ much from the chart, except through the effect of deviation, so that in such cases the entries should be used for correcting the direction of the wind, &c., but not extracted. In the case of an iron ship the entries should be used but not extracted.

6thly. When the direction of the ship's head is not given enter it roughly by considering whether the wind is fair or foul; if fair, then the general knowledge of the ship's course and a consideration of the noon positions, between which the wind falls, will enable you to enter south-westerly, southerly, or south-easterly outward, and the contrary homeward.

This entry is valuable when we consider that our method of extracting so pulls a log to pieces that outward and homeward extracts are mixed. If the wind be foul, then, the knowledge that the outward ship is bound to the southward, and the homeward to the northward, will be a sufficient guide to estimate the approximate direction of her head.

7thly. The force of the wind needs *very careful* consideration, for it will be found that this entry does not always agree with Beaufort's scale, which gives the conditions under which "a well-conditioned man-of-war" will move at a certain speed, or carry a certain amount of sail. To test the force of the wind it is requisite to discover how many miles the ship has made by D.R., then to consider the conditions under which that distance was made, as to whether she was close-hauled, with a rough or smooth sea, &c. &c.

I consider that a well-conditioned ship *close-hauled*, carrying all sail, with a smooth sea and clean full, will go quite as fast with a given amount of wind as she would when running before the same wind. or a little faster; hence when I find that under these circumstances a ship has averaged more by log than is expressed by the average of the figures in the wind force column, I feel justified in proportionally increasing the entries of wind force, because I should not be justified in supposing that the average of merchant ships sail better than a well-conditioned man-of-war: and if we suppose that they do not sail so well, a still greater increase would have to be made in the force entered.

There is more difficulty in rightly decreasing the force of wind entered. Sometimes, however, a commander seems to enter the speed of the ship instead of the force of the wind; for instance, when force five is entered with the sea smooth, and a remark saying "*light* trade and fine," I am inclined to reduce the force according to the distance which the ship has made by D.R. Some logs have wind force seven or eight with "moderate trade" in the remarks; these are inconsistent and a reduction in force is made. There are, however, many logs which have no remarks on the wind, weather, or sail carried; with them it is dangerous to reduce the force merely by the distance run, because with a strong wind and head sea, or when a ship may have tacked during the 24 hours, the distance made by log is no criterion for the force of the wind; this frequently happens in the S.W. monsoon and the doldrums which are experienced between the Trades.

In some cases commanders have used the land method of notation (1 to 6), in others those figures of Beaufort's scale which correspond with the land method, thus 1–3, 5–7, &c. &c.; in these cases great judgment is required to decide on the figure of Beaufort's scale which ought to be used.

In some instances two methods of notation have been used in different parts of the same log.

It is plain that with a vessel under steam the distance run is no guide, and the only check would be any incongruity between the wind force and the remarks; where there is reason to doubt, but no proof, an entry should be queried.

8thly. The dry and damp bulbs often show too small a difference; if it seldom exceeds two degrees between 20° N. and 10° S. the damp bulb may be considered defective; but if it varies from two to five or more degrees, according to the amount of rain, dew, mist, &c., on one side, and fine clear weather on the other, the observations may be considered good.

Care must be taken to notice if the dry bulb has also been used for the surface water, if so it must be rejected; in one case I noticed that the damp bulb and surface water were given by the same thermometer, which was of course a great mistake. If the log be "excellent" or "very good," or if the dry and damp bulbs have been read to decimals, the errors of the thermometers are to be applied according to the new method; if not, the old method must be used

9thly. Care must be taken to notice if the amount of cloud or blue sky has been given.

10thly. The "direction of upper" requires careful consideration to discover whether the direction *from* or *to* be given, also as to whether they really were upper or only lower clouds. All doubtful entries to be cut out.

11thly. The specific gravity and any interesting remarks are to be underlined with red ink, but any remarks which can be *as well* expressed by letters are to be transferred to the weather column.

12thly. In deciding how many entries are to be extracted preference is to be given to 4 and 10 a.m., noon, 4 and 10 p.m. Sometimes other hours have more valuable entries, such as sea temperatures, weather, &c., which make it right to give them the preference. There are cases where a log is deemed to be only worthy of having one or fewer than five extracts taken from the daily entries.

I wish all cases of doubt to be referred to me.

HENRY TOYNBEE,
Marine Superintendent.

P.S. All alterations in the force of the wind and all rejected logs to be referred to me until I decide otherwise.—H. T.

The Director submitted the Introduction to the Sea Temperature Charts which had been ordered to be prepared (Minutes 1868, p. 71). Read a letter from Capt. Richards approving of it.

Resolved—That this Introduction be printed and the work published.

Mr. Scott reported that the Société Météorologique de France had agreed to exchange publications with the office.

Mr. Scott reported that an Abstract of the Daily Weather Report had been exhibited on a board outside the office every day since February 23.

He reported also that the Weekly Summary of Weather in Western Europe, ordered on the 1st of March to be continued for one month, had gone on for two months, and he requested instructions as to the continuance of each of these works.

Resolved—That the Daily Report be continued but the Summary suspended.

He submitted a scheme for comparing the Telegraphic Weather Intelligence with the weather experienced (see Minutes, April 26), which was approved.

He submitted the name of Mr. T. Jeayes as a candidate for a temporary clerkship at a salary of 25*s.* per week (Minutes, p. 29).

Resolved—That Mr. Jeayes be appointed.

The Committee then adjourned.

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2, *Parliament Street, Monday, May* 17, 1869.

PRESENT:

Mr. Gassiot in the Chair.

Mr. De la Rue.

The Director and the Secretary to the Committee were in attendance.

The Minutes of the last meeting were read and confirmed.

Read a letter from the Board of Fisheries, Edinburgh, stating (*vide* Minutes, p. 6.) that the fishery barometer purchased by Lord Stair for Drumore had been erected at that place. As regards Downies, the fishermen of the place have subscribed 2*l.* 7*s.* 6*d.*, and the proprietors of the estate have agreed to add an equal sum, making in all 4*l.* 15*s.*, and the board accordingly request that a fishery barometer be granted to that station.

Resolved—That the request be complied with.

Read a letter from Capt. Toynbee, submitting two vols. of a register kept by Capt. Henderson, of the barque "Hope," (Minutes, 1868, p. 60,) and drawing attention to their special excellence.

Resolved—That Mr. Scott be instructed to write to Capt. Henderson expressing the thanks of the Committee for his valuable observations.

Capt. Toynbee also suggested the names of Capt. Henderson, Capt. Charles Rawle, and Capt. J. Hayes, as deserving the honour of the present of a copy of the Admiralty Pilot Charts (p. 37).

Resolved—That Capt. Toynbee's recommendation be complied with.

Mr. Scott submitted the following report:—

GENTLEMEN,

I BEG to report that I inspected the telegraphic reporting station at Yarmouth on the 14th inst. I found matters in good order, and I have every reason to hope that the station will continue to be satisfactory.

ROBERT H. SCOTT.

Mr. Scott stated that he had called on the secretary of the Sailors' Home, and on some members of the committee of that institution, and had ascertained that they would be willing to allow a self-recording anemometer and a Milne's barometer (Minutes, pp. 38, 49) to be erected at the Sailors' Home at Yarmouth.

Resolved—That Mr. Scott be instructed to propose to the committee that the care of these instruments be entrusted to the secretary of the Sailors' Home, and that the remuneration for this service be 15*l.* per annum.

Read—A letter from Rear-Admiral Schomberg, stating that an anemometer could be erected on the old lighthouse at Holyhead, under his own superintendence as harbour master.

Resolved—That Mr. Scott be authorized to make arrangements for the erection of the instrument, if possible; the amount of remuneration to the care-taker, to be appointed by Admiral Schomberg, to be 10*l.* per annum.

Mr. Scott submitted a letter which he had received from Dr. H. Bence Jones, inquiring if it would be possible for him to deliver a course of four or six lectures on meteorology at the Royal Institution next winter, and he asked whether the Committee would permit him to deliver such a course of lectures.

Resolved—That the Committee see no objection to Mr. Scott's undertaking the proposed lectures.

The name of Mr. E. James was submitted as a candidate for a temporary clerkship, at a salary of 25*s.* per week.

Resolved—That Mr. James be appointed.

The Secretary presented the following report regarding the records for April 1869, received from the various observatories, and which have been examined at Kew in accordance with the regulations adopted by the Meteorological Committee. (See Minutes, 21st December 1868.)

ANEMOGRAPH.

*Aberdeen.*—The anemograph of this station has been in good action during this month. The records are quite complete.

The orientation was tested on the 14th April and found correct.

No error in tabulation has been discovered at Kew.

Forty remeasurements of direction and velocity have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign | 0·1 | 0·6 |
| (3.) Residual difference (Aberdeen—Kew) | 0·0 | −0·1 |

*Armagh* (February).—This month's results have been examined at Kew according to a method which has been decided upon after consulting with Dr. Robinson.

*Falmouth.*—The anemograph of this station has been in good action during this month.

The records are quite complete.

The orientation was tested on April 8th and found correct.

No error in tabulation has been discovered at Kew.

Forty remeasurements of direction and velocity have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign | 0·1 | 0·6 |
| (3.) Residual difference (Falmouth—Kew) | 0·0 | +0·1 |

*Glasgow.*—The anemograph of this station has been in good action during this month. The records are quite complete.

The orientation was tested on April 9th and found correct.

No error of any consequence has been discovered at Kew.

Forty remeasurements of direction and velocity have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign | 0·2 | 0·5 |
| (3.) Residual difference (Glasgow—Kew) | 0·0 | +0·2 |

*Kew.*—The anemograph of this station has been in good action during this month. The records are quite complete.

The orientation was tested on April 14th and found correct.

No error in tabulation has been discovered.

Forty remeasurements of direction and velocity have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign | 0·1 | 0·5 |
| (3.) Residual difference (Kew[1]—Kew[2]) | 0·0 | −0·2 |

*Stonyhurst.*—The anemograph of this station has been in good action during this month. The records are quite complete.

The orientation was tested on April 16th and found correct.

The following error in velocity has been discovered at Kew:

April 13th, 1 p.m., 19 should be 9.

No error has been discovered in direction.

Forty remeasurements of direction and velocity have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign | 0·2 | 0·5 |
| (3.) Residual difference (Stonyhurst—Kew) | 0·0 | 0·0 |

*Valencia.*—The anemograph of this station has been in good action during this month. The hourly record of direction for April 10th, 11 a.m., has been lost on account of oiling the instrument; seven hourly records both of velocity and direction, extending from 2 to 8 a.m. of April 18th, have been lost on account of stoppage of the clock.

Two hourly records of velocity, viz., noon to 1 p.m. of April 27th, as well as the hourly record of direction for 1 p.m. of that day, have been lost on account of painting the cups; the records are otherwise complete.

The orientation was tested on April the 4th and found correct.

No error has been discovered at Kew.

Forty remeasurements have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign | 0·3 | 0·6 |
| (3.) Residual difference (Valencia—Kew) | −0·2 | +0·1 |

## Barograph.

*Aberdeen.*—The action of the barograph, as well as the photography, have been good during the month. The gas was extinguished from 7 a.m. April 13, to 8 a.m. April 14th, on account of water being in the pipes. Twenty-one hourly records have in consequence been lost; the records are otherwise complete.

The following errors have been detected and put right:

In entry of standard barometer—

April 3, noon, 28·891 should be 28·897

In calculating residual correction—

April 3-4, −·003 should be −·002
„ 4-5, −·003 „ −·002

In applying residual correction—

April 11, 7 p.m., 29·881 should be 29·891

Forty remeasurements have been made at Kew with the following results:

| | In. |
|---|---|
| (1.) Greatest difference | 0·0060 |
| (2.) Mean difference irrespective of sign | 0·0027 |
| (3.) Residual difference (Aberdeen—Kew) | −0·0001 |

The mean monthly difference between simultaneous standard and tabulated readings is 0·0018.

*Armagh.*—The action of the barograph, as well as the photography, have been very good during this month, except that there is still a slight bend at the commencement of each sheet. The photographic record for April 21, 10 a.m., is wanting, but in consequence of the standard barometer having been observed the hourly record has not been lost.

The following errors have been detected and put right:

In calculating the residual correction—

April 17-18, +·018 should be +·019
„ 24-25, +·014 „ +·015
„ 30-1, +·008 „ +·009

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0050 |
| (2.) Mean difference irrespective of sign | 0·0018 |
| (3.) Residual difference (Armagh—Kew) | −0·0007 |

The mean monthly difference between simultaneous standard and tabulated readings is 0·0022.

*Falmouth.*—The action of the barograph, as well as the photography, have been good during this month, and the records are quite complete.

The following error has been detected and put right:

In calculating the residual correction—

April 29-30, −·010 should be −·009

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0060 |
| (2.) Mean difference irrespective of sign | 0·0026 |
| (3.) Residual difference (Falmouth−Kew) | −0·0019 |

The mean monthly difference between simultaneous standard and tabulated readings is 0·0022.

*Glasgow.*—The action of the barograph, as well as the photography, have been good during this month.

On April 3d, 10 a.m., the photographic record was lost, on account of the light falling on the binding rods of the cylinder; but the standard barometer having been observed no hourly record has been lost. The gas was out on April 9th from 11 a.m. to 1 p.m., in consequence of which two hourly records have been lost. The clock stopped from 10 p.m., April 15th, to 9 a.m. of April 16th, on account of which 10 hourly records have been lost.

The following errors have been detected and put right:

In entry of standard—

April 3, 10 p.m., 29·119 should be 29·199

In applying residual correction—

April 11, 2 a.m., 29·870 should be 29·864
„ 22, 10 a.m., 29·753 „ 29·755

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0050 |
| (2.) Mean difference irrespective of sign | 0·0027 |
| (3.) Residual difference (Glasgow−Kew) | +0·0010 |

The mean monthly difference between simultaneous standard and tabulated readings is ·0023.

*Kew.*—The action of the barograph, as well as the photography, have been good during this month. There was a failure of gas on April 14th from 5 to 9 a.m., on account of which five hourly records have been lost. Also on April 25, 1 to 2 a.m., on account of which two hourly records have been lost. Also on April 26th, from 1 to 4 a.m., on account of which four hourly records have been lost.

The following errors have been detected and put right:

In entry of standard reading—

April 9, 4 p.m., 30·014 should be 30·114

In calculating the residual correction—

April 10-11, −·014 should be −·013

In applying the residual correction—

April 24, 5 p.m., 29·988 should be 30·088
„ 24, 6 p.m., 29·996 „ 30·096
„ 27, 6 p.m., 30·123 „ 30·133
„ 28, 11 p.m., 30·316 „ 30·326
„ 30, 7 a.m., 30·181 „ 30·191

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0050 |
| (2.) Mean difference irrespective of sign | 0·0019 |
| (3.) Residual difference ($Kew^1-Kew^2$) | −0·0007 |

The mean monthly difference between simultaneous standard and tabulated readings is 0·0017.

*Stonyhurst.*—The action of the barograph, as well as the photography, have been good during this month, and the records are quite complete.

The following errors have been discovered and put right:

In entry of standard reading—

April 16th, reading at 4 p.m. entered in tabulation sheet at 2 p.m.

In applying residual correction—

April 6, 4 p.m., 29·437 should be 29·438
„ 6, 6 p.m., 29·422 „ 29·423
„ 6, 7 p.m., 29·421 „ 29·422
„ 9, 11 p.m., 29·695 „ 29·690
„ 10, noon, 29·641 „ 29·644
„ 12, 7 a.m., 29·732 „ 29·733
„ 16, noon, 28·660 „ 28·670
„ 28, 7 a.m., 29·994 „ 29·984

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0070 |
| (2.) Mean difference irrespective of sign | 0·0030 |
| (3.) Residual difference (Stonyhurst−Kew) | +0·0001 |

The mean monthly difference between simultaneous standard and tabulated readings is ·0021.

*Valencia.*—The action of the barograph, as well as the photography, have been good during this month, and the records are quite complete.

The following errors have been discovered and put right:

In calculating the residual correction—

April 3-4, −·001 should be −·002
„ 4-5, −·006 „ −·002
„ 9-10, −·015 „ −·018
„ 19-20, −·014 „ −·010

In applying the residual correction—

April 22, 1 a.m., 29·745 should be 29·746

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0050 |
| (2.) Mean difference irrespective of sign | 0·0020 |
| (3.) Residual difference (Valencia—Kew) | + 0·0003 |

The mean monthly difference between simultaneous standard and tabulated readings is ·0018.

*Valencia* (January).—The action of the barograph, as well as the photography, have been good during this month, and the records are quite complete.

The following errors have been discovered and put right:

In calculating residual correction—

Jan. 13, −·014 should be −·019
„ 17, −·020 „ −·015
„ 19, −·027 „ −·028
„ 24, −·014 „ −·018

In applying the residual correction—

Jan. 22, 6 p.m., 30·165 should be 30·161
„ 20, 2 p.m., 30·076 „ 30·171

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0060 |
| (2.) Mean difference irrespective of sign | 0·0017 |
| (3.) Residual difference (Valencia—Kew) | + 0·0001 |

The mean monthly difference between simultaneous standard and tabulated readings is ·0029.

## Thermograph.

*Aberdeen.*—The Aberdeen thermograph has been in good action during the month of April, and the photography has been good. There was a failure of gas from 7 a.m. of April 13th to 8 a.m. of April 14th, in consequence of which 21 hourly records have been lost for both bulbs. The wet bulb was out of action at 3 a.m. on April 3d, through the action of frost; the records are otherwise complete.

The following error in tabulation has been detected and put right:

April 6th, 6 a.m., wet bulb, 40·1 should be 41·1.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign | 0·13 | 0·13 |
| (3.) Residual difference (Aberdeen—Kew) | — 0·08 | + 0·10 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·12 | 0·16 |

*Armagh.*—The instrument has been in good action during April, and the photography has been very good. The records for both bulbs are quite complete.

The following errors in tabulation have been detected and put right:

Dry bulb, April 20, 5 p.m., 52·1 should be 51·0
„ „ 21, 3 a.m., 43·8 „ 43·0
Wet bulb „ 20, 3 p.m., 49·8 „ 49·3
„ „ 20, 5 p.m., 48·0 „ 47·0
Dry bulb „ 26, 11 p.m., 52·3 „ 51·3
Wet bulb, from 25th 8 p.m. till 26th 5 a.m. wrongly tabulated.
28, 9 „ 42·0 should be 43·0.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign | 0·14 | 0·15 |
| (3.) Residual difference (Armagh—Kew) | — 0·12 | — 0·02 |

The mean monthly difference between simultaneous standard and tabulated readings, is—

| Dry. | Wet. |
|---|---|
| 0·14 | 0·16 |

*Falmouth.*—The instrument has been in good action during April, and the photography has been good. The records for the dry bulb are quite complete; three hourly records of the wet bulb on April 3d, from 6 to 8 p.m., have been lost on account of there not being sufficient water to the bulb; four hourly records on April 4th, from 5 to 8 a.m., have been lost through the same cause. Four hourly records, April 25th, 11 to noon, and 2 to 3 p.m., have been lost through want of light; the records are otherwise complete. No error of any consequence has been discovered at Kew.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - - | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign - - - | 0·09 | 0·11 |
| (3.) Residual difference (Falmouth — Kew) - | -+0·03 | +0·10 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·10 | 0·10 |

*Glasgow.*—The instrument has been in good action during April, and the photography has been good. The photographic traces of the dry bulb from 1 to 7 p.m. of April 11th, and from 11 a.m to 3 p.m. of April 12th, have been lost through want of light; nine hourly values have thus been lost; the dry-bulb records are otherwise complete. The wet-bulb records are quite complete. The following error in tabulation has been detected and put right:

Dry bulb, April 21st, 1 p.m., 54·2 should be 53·5
„ „ 4 p.m., 54·4 „ 56·0

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - - | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign - - - | 0·12 | 0·10 |
| (3.) Residual difference (Glasgow—Kew) - - | --0·09 | +0·07 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·12 | 0·11 |

*Kew.*—The instrument has been in good action during April, and the photography has also been good. There was a failure of gas on April 22d from 6 to 7 p.m., in consequence of which two hourly records have been lost for both bulbs. The action of the wet bulb was occasionally deficient during the east winds from April 26th to April 28th; on account of this eight hourly records have been lost. The records are otherwise complete. The following errors in tabulation have been discovered and put right:

Dry bulb, April 17th, 3 p.m., 50·6 should be 49·6
Wet bulb „ 29th, 11 a.m., 45·0 „ 46·0

Forty remeasurements have been made with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·03 | 0·03 |
| (2.) Mean difference irrespective of sign - - | ·08 | ·06 |
| (3.) Residual difference ($Kew^1$—$Kew^2$) - - | +0·02 | +0·01 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| ·08 | ·06 |

*Stonyhurst.*—The instrument has been in good action during April, and the photography has also been good. The light was deficient on April 10th, 3 p.m., on account of which one hour's record of the dry bulb has been lost; it was also deficient from 9 to 10 a.m. of April 16th, on account of which two hourly records of the dry bulb have been lost; the dry-bulb records are otherwise complete. The wet bulb was out of action on account of frost on April 1st, 8 a.m., on account of which one hourly record has been lost. The light was deficient on April 19th, 4 to 5 a.m., on account of which two hourly records of the wet bulb have been lost. The wet bulb was out of action from 1 to 5 a.m. of April 22d, on account of which four hourly records have been lost. The light was deficient from 2 till 6 a.m. of April 24th, on account of which five hourly records of the wet bulb have been lost. The wet-bulb records are otherwise complete. The following errors have been detected and put right:

In entry of standard reading—

April 9th, 10 a.m., dry bulb, 51·5 should be 41·5.

In tabulation—

Wet bulb re-tabulated from April 8th, 1 a.m., to April 9th, 10 a.m., owing to the first tabulations being made from an erroneous setting of the scale.

Dry bulb, April 23, 7 a.m., 45·9 should be 46·7
Wet „ „ 29, 11 a.m., 44·0 „ 43·0

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign - - | 0·12 | 0·10 |
| (3.) Residual difference (Stonyhurst—Kew) - - | 0·0 | —0·01 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| ·14 | ·16 |

*Valencia.*—The instrument has been in good action during April, and the photography has also been good. The records for both bulbs are quite complete.

The following errors have been detected and put right:

In tabulation—

Dry bulb for April 10th re-tabulated, the first measurements being made from an erroneous setting of the scale.

Wet bulb re-tabulated from same cause from April 9th, 11 a.m., to April 10th, 3 p.m.

Dry bulb re-tabulated from same cause from 1 to 10 a.m. of April 11th.

Wet bulb re-tabulated from same cause from 11 a.m., till midnight of April 17th.

A few slight errors in maxima and minima have been detected and put right.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign - - | 0·14 | 0·11 |
| (3.) Residual difference (Valencia—Kew) - - | 0·0 | —0·07 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| ·13 | ·17 |

In the following table the number of hourly records lost during the month of March is exhibited.

| Station. | Anemograph. | | Barograph. | Thermograph. | | |
|---|---|---|---|---|---|---|
| | | | | Dry. | Wet. | |
| | Direction. | Velocity. | | | Frost. | Other Causes. |
| Aberdeen - - - | 0 | 0 | 21 | 21 | 0 | 22 |
| Armagh (February) - - | 0 | 0 | 0 | 0 | 0 | 0 |
| Falmouth - - - | 0 | 0 | 0 | 0 | 0 | 11 |
| Glasgow - - - | 0 | 0 | 12 | 9 | 0 | 0 |
| Kew - - - - | 0 | 0 | 11 | 2 | 0 | 10 |
| Stonyhurst - - - | 0 | 0 | 0 | 3 | 1 | 11 |
| Valencia - - - | 9 | 9 | 0 | 0 | 0 | 0 |
| Valencia (January) - - | — | — | 0 | — | — | — |

The following cheque was drawn :—

| | £ | *s.* | *d.* |
|---|---|---|---|
| J. S. Harding, jun., office expenses - - - - | 15 | 0 | 0 |

The Committee then adjourned.

2, *Parliament Street, Monday, May* 24, 1869.

PRESENT:

General Sabine in the chair.

| | |
|---|---|
| Mr. Galton. | Dr. W. A. Miller. |
| Mr. Gassiot. | Mr. Spottiswoode. |

Mr. De La Rue.

The Director and the Secretary to the Committee were in attendance.

The minutes of the last meeting were read and confirmed.

Mr. Scott stated that suggestions as to the best method of dealing with the curves, (Minutes, 1868, p. 89) had been received from 17 gentlemen, viz., The Astronomer Royal, Mr. Baxendell, Mr. Buchan, Signor Capello, Mr. Galton, Mr. Park Harrison, Sir J. Herschel, M. Le Verrier, Mr. Meldrum, Mr. Merrifield, M. Mohn, Dr. Mühry, Mr. Perry, Mr. Russell, Mr. Rundell, Capt. Toynbee, and M. Zurcher.

The most important suggestions contained in the letters referred to the necessity of reducing the scale of the photograms. In order to see the most approved mode of effecting this object, Mr. De La Rue had kindly afforded Mr. Stewart and him an opportunity of seeing Wagner's pantagraph at work. Proofs of engravings executed by this instrument were submitted. Mr. Scott stated that the cost of the apparatus was 180*l.* It would require the time of two persons, one to work it, the other to etch the plates.

Mr. Galton suggested that it was very desirable that the work should be executed by a special instrument, which would reduce the records in different proportions vertically and horizontally. He believed that such an instrument could be easily made.

Resolved—That Mr. Galton be requested to have a model of such a pantagraph made, cost not to exceed 10*l.*

Read—A letter from Capt. Richards with reference to Capt. Toynbee's paper respecting the winds, &c., of the Atlantic (Minutes, 1869, p. 22).

Resolved—That the paper be printed in the Nautical Magazine, as suggested by Capt. Richards, 250 private copies to be obtained for distribution at the expense of the office.

Read—Letter from Capt. Toynbee recommending the name of Capt. H. P. Wight, ship "Gosforth," (Minutes, 1868, p. 60) for a presentation copy of the Admiralty Pilot Charts.—Approved.

Read—A letter from Professor Mühry of Göttingen, respecting the point of maximum density of sea-water.

Mr. Stewart explained that, following the suggestion of Dr. Miller, he had found that the best method of checking the accuracy of the wet-bulb instrument would be by absolute observations with Regnault's hygrometer.

Resolved—That, with the concurrence of the Kew Committee, two daily observations of the dew-point be made at Kew by means of Regnault's hygrometer.

Mr. Stewart stated that he should commence the observations without delay.

Resolved—That the hourly values of the hygrometric quality of the air at the various observatories be calculated for some one month, embracing some marked atmospherical disturbance, and that Mr. Stewart report as to the best method of framing tables for this and analogous hygrometric reductions.

Read—A letter from the Rev. Mr. Kerr asking whether the Committee were disposed to grant him a holiday.

Resolved—That Mr. Kerr be allowed one month's holiday, provided that the business does not suffer in his absence.

The Committee then adjourned.

116, *Victoria Street, June* 7, 1869.

PRESENT:

General Sabine in the Chair.

| | |
|---|---|
| Capt. Richards. | Dr. W. A. Miller. |
| Mr. Galton. | Mr. Gassiot. |
| Mr. Spottiswoode. | Mr. De La Rue. |

The Director and the Secretary to the Committee were in attendance.

The Minutes of the last meeting were read and confirmed.

Mr. Scott reported that he had received full permission to erect anemometers at Holyhead and Yarmouth (Minutes, p. 54).

The question of the use of a pantograph having been brought forward—

Mr. De la Rue reported that he had seen Herr Wagner of Berlin, and had called with him at the Meteorological Office, in order that he might see the curves to be dealt with. Herr Wagner stated that he had made several machines which were capable of reducing any two co-ordinates to different scales, and that on his return to Berlin he would write to the Director, stating the cost of an instrument suitable to the requirements of the Meteorological Office.

Mr. Galton exhibited a model of a pantograph which he had prepared in accordance with a resolution of the Committee at the meeting on May 24th. The Committee decided that this model be tried at Kew in tracing curves reduced in certain definite proportions, varying these proportionate reductions according to Mr. Stewart's judgment in two or three storms. The curves to be prepared for the Committee's inspection.

The proportions to include—

For barogram and thermogram—

$$\tfrac{1}{2} \;\&\; \tfrac{1}{6} - \tfrac{1}{3} \;\&\; \tfrac{1}{6} - \tfrac{1}{3} \;\&\; \tfrac{1}{8}$$

For wind—

$$\tfrac{1}{3} \;\&\; \tfrac{1}{6} - \tfrac{1}{4} \;\&\; \tfrac{1}{8}$$

The datum line to be kept uniform.

Mr. Stewart presented a scheme for hygrometric reductions, as the report requested of him at the last meeting.

Resolved—That Mr. Stewart be allowed to expend 25*l.* in reducing six months' observations at Kew, giving 5 day hourly means of temperature of air, barometrical pressure, vapour pressure, dew-point, fractional saturation, mass of dry air, mass of vapour, velocity N. and S., velocity E. and W., besides hourly values of hygrometric quality.

That Mr. Stewart be empowered to have the necessary tables printed and a scale for the reductions made.

Mr. Scott inquired whether civil or astronomical time was to be used in the reductions of the observatory records, and he was instructed to employ astronomical time.

He was further instructed to cause the following mean values to be calculated for the six months beginning July 1st, 1868, for all the observatories.

Table I.—*Monthly Means* of pressure, temperature, vapour pressure, and dry-air pressure, with the maximum and minimum amounts of the first two elements.

Table II.—*Five-day Means* (commencing June 30th), of pressure, temperature, and wet-bulb readings.

The above are tables submitted by General Sabine on the 25th January (Minutes, 1869, p. 11.) Table III. for periodic corrections was not ordered to be calculated at present.

Read—A letter from Captain Toynbee, submitting the registers kept by Captain Martyn and Captain Watson of the Cunard Service, which were of great excellence, and recommending these gentlemen for presentation copies of the Admiralty Pilot Charts.

Resolved—That Mr. Scott be instructed to write to Captain Martyn and Captain Watson, thanking them for their registers, and that copies of the Pilot Charts be presented to them.

Read—A letter from Captain Toynbee, stating that the facts contained in the registers just referred to confirmed the views advanced in his paper submitted at last meeting.

Resolved—That this paper be printed for private circulation by the office.

The Hydrographer requested that any tidal observations made in the Arctic or Antarctic regions, and which may be contained in the meteorological registers or other papers in the Meteorological Office, may, as they come to hand, be transmitted to the hydrographical department of the Admiralty.

Resolved—That all tidal observations be sent to the Admiralty from this time forth.

Read—A letter from Mr. Clouston, stating that Mr. Beckley had reached Sandwick, and that he had found that a new wooden house for the anemometer was required.

Mr. Scott requested permission to purchase a strong box for keeping cash, &c. in the office, and was authorized to procure a second-hand one at a cost not exceeding 5*l.*

The following cheques were drawn:—

| | £ | *s.* | *d.* |
|---|---|---|---|
| For Salaries for May: | | | |
| R. H. Scott | 66 | 13 | 4 |
| H. Toynbee | 33 | 6 | 8 |
| B. Stewart | 33 | 6 | 8 |
| W. Salmon | 18 | 6 | 8 |
| J. S. Harding, jun. | 14 | 3 | 4 |
| R. Strachan | *16 | 13 | 4 |
| S. Jeffery (4 weeks, to 26th) | 12 | 0 | 0 |
| F. Gaster | 10 | 16 | 8 |
| C. Harding | 9 | 3 | 4 |
| R. H. Curtis | 7 | 10 | 0 |
| F. Steventon | 6 | 13 | 4 |
| J. S. Harding, sen. (4 weeks, to 26th) | 7 | 14 | 0 |
| E. Magrath (4 weeks, to 29th) | 5 | 0 | 0 |
| A. D. Spencer „ | 5 | 0 | 0 |
| J. Curtis „ | 5 | 0 | 0 |
| G. Francis „ | 3 | 0 | 0 |
| G. Brodie „ | 3 | 0 | 0 |
| For Telegraphy: | | | |
| Electric Telegraph Company, April £58 1 4 | | | |
| Ditto special charges, March 21 13 1 | | | |
| | 79 | 14 | 5 |
| Magnetic Telegraph Company, April | 55 | 0 | 1 |
| Submarine ditto ditto | 33 | 3 | 9 |
| For Observatories: | | | |
| T. Weeks, leather cases | 0 | 19 | 0 |
| T. Kerr, salary for May | 20 | 16 | 8 |
| For Contingencies: | | | |
| R. H. Scott, extra work of staff | 21 | 0 | 0 |
| J. H. Parsons, on account (fittings) | 50 | 0 | 0 |
| Office, Petty Expenses: | | | |
| J. S. Harding, junior, on account | 25 | 0 | 0 |
| Total | £543 | 1 | 3 |

The Committee then adjourned.

* Including allowance for care of Instruments.

116, *Victoria Street, June* 22, 1869.

PRESENT:

General Sabine in the Chair.

Dr. W. A. Miller. | Mr. Galton.
Captain Richards. | Mr. Gassiot.
Mr. Spottiswoode.

The Director and the Secretary to the Committee were in attendance.

The Minutes of the last meeting were read and confirmed.

Mr. Stewart exhibited tracings of the curves made by means of the model pantograph submitted by Mr. Galton at the last meeting.

It was suggested—That the barometrical and thermometrical tracings on the scale of a quarter vertical and one-eighth in time be cut up and remounted in a more open manner, so as to allow room for each barogram to range through not less than two inches, and each thermogram through not less than 50° Fahrenheit. The spaces occupied by the curves to be separated by double lines. The wind tracings to be remounted and made to occupy a page of corresponding size to the above.

It was resolved—That the Kew Committee be requested to undertake the construction of a model for the copying stage of the pantograph on Mr. Galton's principle, and that Mr. Galton be requested to give precise explanations as to what is required to be done.

Mr. Scott requested instructions as to completing the annual report and sending it to press, and it was resolved that the report be completed without delay.

Mr. Scott stated that he had ventured to request the Chairman to communicate to the Royal Society at their meeting on the 17th inst. a short paper "On the relations between "oppositely disposed air currents and the weather subsequently experienced in the "British Islands."

The paper had not been completed on the 7th inst., so that he had been unable to obtain the Committee's sanction to its presentation.

Mr. Scott reported that an application had been made to him by Mr. Parsons, one of the contractors for fitting up the office, for an advance of 100*l.*, and that a cheque had been drawn by the chairman for that amount.

Read—A letter from Dr. Robinson, of Armagh, to Mr. Stewart, stating that assistance to replace Mr. Call in case of illness or absence might be had for 20*l.* per annum.

Resolved—That an allowance at the rate of 20*l.* per annum be placed at the disposal of Dr. Robinson for this purpose, to commence from 1st July next.

The Secretary presented the following report regarding the records for the self-recording instruments of the various observatories, and which have been examined at Kew in accordance with the regulations adopted by the Meteorological Committee. (See Minutes, 21st December 1868.)

ANEMOGRAPH.

*Aberdeen.*—The anemograph at this station has been in good action during the month. The records are quite complete.

The orientation was tested on May 8th and found to be correct.

No error in tabulation has been discovered at Kew.

Forty remeasurements of direction and velocity have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference - - - - | 1·0 | 2·5 |
| (2.) Mean difference irrespective of sign - - | 0·3 | 0·9 |
| (3.) Residual difference (Aberdeen—Kew) - | 0·0 | 0·0 |

*Armagh.*—The anemograph at this station has been in good action during the month. There was, however, a stoppage of the clock on May 7th, 9 a.m. to 11 a.m., and May 8th, 1 a.m. to 11 a.m. and 1 p.m. to 3 p.m., in consequence of which 16 hourly records of velocity and 14 hourly records of direction have been lost, also the clock was out of order from May 9th, 11 a.m., to May 10th, 11 a.m., by

which 25 hourly records of velocity have been lost; also on May 4th the paper was torn by pencil, causing eight hourly records of velocity to be lost. The records are otherwise complete.

No error in tabulation has been discovered at Kew.

Forty remeasurements of direction and velocity have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference - - - - | - 1·5 | 3·0 |
| (2.) Mean difference irrespective of sign - - | - 0·4 | 1·0 |
| (3.) Residual difference (Armagh—Kew) - | +0·1 | +0·1 |

*Falmouth.*—The anemograph at this station has been in good action during the month.

The records are quite complete.

The orientation was tested on May 28th and found correct.

No error in tabulation has been discovered at Kew.

Forty remeasurements of direction and velocity have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference - - - - | - 1·0 | 3·0 |
| (2.) Mean difference irrespective of sign - - | - 0·3 | 0·7 |
| (3.) Residual difference (Falmouth—Kew) - | - 0·0 | +0·2 |

*Glasgow.*—The anemograph at this station has been in good action during the month.

The records are quite complete.

No error in tabulation has been discovered at Kew.

Forty remeasurements of direction and velocity have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference - - - - | - 1·0 | 3·0 |
| (2.) Mean difference irrespective of sign - - | - 0·2 | 0·9 |
| (3.) Residual difference (Glasgow—Kew) - | - 0·0 | —0·5 |

*Kew.*—The anemograph at this station has been in good action during the month. Twenty-four hourly records of direction, extending from 10.30 a.m. of May 21st to 10.30 a.m. of the 22nd, have been lost owing to the pencil not touching the paper. The records are otherwise complete.

The orientation was tested on May 20th and found to be correct.

No error has been discovered at Kew.

Forty remeasurements of velocity and direction have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference - - - - | - 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign - - | - 0·1 | 0·6 |
| (3.) Residual difference ($Kew^1$—$Kew^2$) - - | —0·1 | 0·0 |

*Stonyhurst.*—The anemograph at this station has been in good action during the month. The records are quite complete.

No error in tabulation has been discovered at Kew.

The orientation was tested on May 21st and found correct.

Forty remeasurements have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference - - - - | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign - - | 0·1 | 0·8 |
| (3.) Residual difference (Stonyhurst—Kew) - - | +0·1 | —0·2 |

*Valencia.*—The anemograph at this station has been in good action during the month. There was, however, a stoppage of the clock on Saturday May 22nd from 8 a.m. to 10 a.m. by which three hours were lost, both for velocity and direction; the records are otherwise complete.

The orientation was tested on May 10th and found correct.

No error in tabulation has been discovered at Kew.

Forty remeasurements of velocity and direction have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference - - - - | 1·0 | 3·0 |
| (2.) Mean difference irrespective of sign - - | 0·1 | 1·0 |
| (3.) Residual difference (Valencia—Kew) - - | 0·0 | +0·4 |

## Barograph.

*Aberdeen.*—The action of the Aberdeen barograph, as well as the photography, have been good during this month. The records are quite complete.

The following errors have been detected and corrected:

In application of residual correction—

May 8th, 9 p.m., 29·649 should be 29·646
„ 26th, 9 a.m., 29·829 „ 29·828

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·005 |
| (2.) Mean difference irrespective of sign | 0·0022 |
| (3.) Residual difference (Aberdeen—Kew) | 0·0008 |

The monthly mean difference between simultaneous barograph and standard readings is ·0013.

*Armagh.*—The action of the Armagh barograph, as well as the photography, have been good during this month; the records are quite complete.

There is still a slight bend at the commencement of each sheet.

The following errors have been detected and put right:

In calculating residual correction—

| | | | |
|---|---|---|---|
| May 1st | (morning) | +·008 | should be +·009 |
| „ 1st | (afternoon) | +·014 | „ +·017 |
| „ | 9-10 | +·016 | „ +·017 |
| „ | 14-15 | +·014 | „ +·015 |

In application of residual correction—

May 5th, 10 a.m., 29·789 should be 29·689
„ 26th, 10 p.m., 29·532 „ 29·552

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·005 |
| (2.) Mean difference irrespective of sign | 0·0021 |
| (3.) Residual difference (Armagh—Kew) | —0·0006 |

The mean monthly difference between simultaneous barograph and standard readings is ·0021.

*Falmouth.*—The action of the Falmouth barograph, as well as the photography, have been good during this month, and the records are quite complete.

The following errors have been detected and put right:

In entry of standard readings—

May 29th, 8. p.m., 29·668 should be 29·968.

In calculating residual correction—

May 10–12, +·019 should be +·017.

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0060 |
| (2.) Mean difference irrespective of sign | 0·0017 |
| (3.) Residual difference (Falmouth—Kew) | +0·0004 |

The mean monthly difference between simultaneous barograph and standard readings is 0·0021.

*Glasgow.*—The Glasgow barograph has been in good action during the month of May, and the photography has been good, excepting that some of the sheets are somewhat discoloured, also rather faint. In consequence of this four hours' record have been lost, on May 5th, from 3 p.m. to 6 p.m.; also the trace is indistinct at 10 a.m. on the 7th, but a standard reading having been taken at that hour, the hourly record is not lost. In all four hourly records have been lost.

The following errors have been detected and corrected:

In calculating residual correction—

May 11–12, +·025 should be +·026.

In application of residual correction—

May 1, 3 a.m., 30·056 should be 30·058.

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0060 |
| (2.) Mean difference irrespective of sign | 0·0026 |
| (3.) Residual difference (Glasgow—Kew) | —0·0008 |

The mean monthly difference between simultaneous barograph and standard readings is 0·0025.

*Kew.*—The Kew barograph has been in good action during this month, and the photography has been good. On May 19, 10 a.m., and also May 25, 10 a.m., the curves are blurred, but standard readings having been taken at these hours, the hourly records are not lost. The records are otherwise complete.

The following errors have been detected and corrected:

In application of residual correction—

May 3rd, 2 a.m., 30·027 should be 30·025
„ 22, 6 a.m., 29·928 „ 29·927
„ „ noon, 29·983 „ 29·993
„ „ 4 p.m., 30·024 „ 30·022

In entry of standard readings—

May 28th, 29·811 should be 29·911

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0050 |
| (2.) Mean difference irrespective of sign | 0·0019 |
| (3.) Residual difference (Kew$^1$ − Kew$^2$) | − 0·0007 |

The mean monthly difference between simultaneous barograph and standard readings is 0·0016.

*Stonyhurst.*—The Stonyhurst barograph has been in good action during this month; the photography has been good, except that curve No. 142–143 is rather faint; the records are quite complete.

The following errors have been detected and corrected:

In calculating residual correction—

May 1–2, + 0·003 should be + ·002

In applying residual correction—

May 3, 5 p.m., 29·491 should be 29·501
„ 4, 4 a.m., 29·470 „ 29·480

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0060 |
| (2.) Mean difference irrespective of sign | 0·0025 |
| (3.) Residual difference (Kew$^1$ − Kew$^2$) | − 0·0007 |

The mean monthly difference between simultaneous barograph and standard readings is 0·0022.

*Valencia.*—The Valencia barograph has been in good action, and the photography has been good, except that curve 144–145 is somewhat faint. The records are quite complete.

The following errors have been discovered and corrected:

In entry of standard reading—

May 1, 10 p.m., 29·913 should be 30·013

In calculating residual correction—

May 2–3, − ·012 should be − ·014
„ 6–7, − ·006 „ − ·005
„ 13–15, − ·015 „ − ·017
May 16 (morning) − ·011 „ − ·010
May 16–17, − ·007 „ − ·010
„ 25–26, − ·010 „ − ·013
„ 30–31, − ·017 „ − ·012

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0060 |
| (2.) Mean difference irrespective of sign | 0·0025 |
| (3.) Residual difference (Valencia − Kew) | + 0·0012 |

The mean monthly difference between simultaneous barograph and standard readings is ·0016.

## Thermograph.

*Aberdeen.*—The Aberdeen thermograph has been in good action during the month of May, and the photography is good. The traces for both bulbs are quite complete.

A few errors have been discovered and corrected, as follows:

In tabulation—

Dry bulb, 12th, midt., 39·0 should be 41·0
Wet „ 11th, 3 p.m., 43·9 „ 44·9

The wet bulb from 11 a.m. till midnight on 31st was retabulated, as the differences between the standard and first tabulated readings were too large; there was also a slight error in the minimum on the 16th and 23rd.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign | 0·10 | 0·13 |
| (3.) Residual difference (Aberdeen − Kew) | − 0·01 | + 0·06 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·12 | 0·15 |

*Armagh.*—The Armagh thermograph has been in good action during the month of May, the photography has also been very good. The traces for the dry bulb are quite complete.

There was scarcely sufficient water to the wet bulb on the 14th at 11 a.m., by which that hourly reading has been rendered doubtful; it was also out of action on two other occasions, but as the standard was then read no hourly reading has been lost.

The following errors have been discovered and corrected:

In tabulation—

| | | | | |
|---|---|---|---|---|
| Wet bulb | 8th | 8 a.m., 40·0 | should be | 39·2 |
| „ | 8th | 9 a.m., 40·2 | „ | 39·3 |
| Dry bulb | 11th | 2 a.m., 39·9 | „ | 37·4 |
| „ | 14th | 9 a.m., 49·0 | „ | 49·7 |
| „ | 21st | 1 p.m., 54·8 | „ | 55·8 |
| „ | 22nd | 4 p.m., 56·5 | „ | 51·6 |
| Wet bulb | 19th | 4 p.m., 46·9 | „ | 46·0 |
| „ | 20th | 3 p.m., 45·6 | „ | 44·8 |
| Dry bulb | 28th | 7 p.m., 47·0 | „ | 50·5 |
| „ | 31st | 9 a.m., 50·5 | „ | 51·7 |
| Wet bulb | 31st | 9 a.m., 47·3 | „ | 48·5 |

The dry bulb was re tabulated from 1 till 10 a.m. on 13th, and the wet bulb from 11 on 9th till 6 a.m. on 10th, also on 11th from 1 a.m. till 13th 10 a.m.

A few slight errors in maxima and minima have been discovered and corrected.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·4 | 0·3 |
| (2.) Mean difference irrespective of sign - - | 0·10 | 0·13 |
| (3.) Residual difference (Armagh—Kew) - - | 0·0 | −0·10 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| ·11 | ·16 |

*Falmouth.*—The Falmouth thermograph has been in good action during May, and the photography has also been good.

The dry bulb traces are quite complete. The wet bulb was out of action on the 11th at 9 and 10 a.m. and 3 and 4 p.m., on 12th at 11 a.m. and noon, on 13th at 9 and 10 a.m. and 3 and 4 p.m., on 14th from 1 a.m. till 8 a.m., and at 1, 2, and 4 p.m., and on the 20th at 3 and 4 p.m. The standard was read on several occasions so that in all 19 hourly traces have been lost for this instrument; the wet bulb traces are otherwise complete. No errors have been discovered.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·4 | 0·2 |
| (2.) Mean difference irrespective of sign - - | 0·13 | 0·08 |
| (3.) Residual difference (Falmouth — Kew) - | +0·06 | 0·0 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·8 | 0·8 |

*Glasgow.*—The Glasgow thermograph has been in good action during May, and the photography has been good with the exception of a few photographic blemishes. The traces for the dry bulb are quite complete. The wet bulb was out of action on the 8th at 10 a.m. and at 7 and 8 p.m., on 14th at 7 and 8 p.m., on 15th at 9 and 10 a.m., on 24th at 9 and 10 a.m. and 5, 6, 7, and 8 p.m. The standard was read on one or two occasions so that in all ten hourly values of the wet bulb have been lost. The records are otherwise complete. No errors of any consequence have been discovered.

Forty remeasurements have been made with the following results:

| | Dry | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign - - | 0·11 | 0·11 |
| (3.) Residual difference (Glasgow—Kew) - - | −0·06 | +0·08 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| ·11 | ·12 |

*Stonyhurst.*—The Stonyhurst thermograph has been in good action during May, and the photography has also been very good.

The traces for both bulbs are quite complete.

The following errors have been discovered and corrected:

In entry of standard reading—

| | | | | |
|---|---|---|---|---|
| Dry bulb, | 7th at 10 a.m., | 48·7 | should be | 48·9 |
| „ | 10th at noon | 45·1 | „ | 55·1 |
| „ | 25th at 4 p.m., | 41·8 | „ | 51·8 |
| „ | 27th at 8 a.m., | 45·8 | „ | 45·3 |

In tabulation—

Dry bulb on 25th, 3 p.m., 45·5 should be 50·5.

There are no other errors of any consequence.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·3 | 0·2 |
| (2.) Mean difference irrespective of sign - - | 0·07 | 0·08 |
| (3.) Residual difference (Stonyhurst—Kew) - - | +0·01 | +0·02 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·09 | ·11 |

*Kew.*—The Kew thermograph has been in good action during May, the photography has also been good with the exception of a few sheets which are slightly discoloured. On the 22nd at 10 a.m. the cylinder stopped by some means unaccountable for six hours; three hourly traces only were lost for both bulbs, as the standards were observed during that time. The records are otherwise complete.

The following error in tabulation has been discovered and corrected:

Wet bulb, 19th, 1 p.m., 42·7 should be 44·0

Forty remeasurements have been made with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference | 0·2 | 0·3 |
| (2.) Mean difference irrespective of sign | 0·05 | 0·06 |
| (3.) Residual difference (Kew[1]—Kew[2]) | —0·01 | —0·02 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| ·07 | ·09 |

*Valencia.*—The Valencia thermograph has been in good action during May, the photography has also been very good. The traces for both bulbs are quite complete. One or two slight errors have been discovered and corrected, as follows:

In entry of standard reading—

Dry bulb, 22nd, at 10 p.m., 56·1 should be 46·1

The wet bulb was retabulated from 1 a.m. on the 10th till 10 a.m. on 11th in consequence of the first measurement being made from an erroneous setting of scale.

The minimum was slightly wrong on 3rd, 4th and 31st.
Maximum of 10th, 47·6 should be 52·6.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference | 0·3 | 0·2 |
| (2.) Mean difference irrespective of sign | 0·09 | 0·06 |
| (3.) Residual difference (Valencia—Kew) | + 0·04 | + 0·0 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| ·16 | ·18 |

In the following table the number of hourly records lost during the month of May is exhibited:

| Station. | Anemograph. | | Barograph. | Thermograph. | |
|---|---|---|---|---|---|
| | | | | Dry. | Wet. |
| | Direction. | Velocity. | | | |
| Aberdeen | 0 | 0 | 0 | 0 | 0 |
| Armagh | 14 | 49 | 0 | 0 | 1 |
| Falmouth | 0 | 0 | 0 | 0 | 19 |
| Glasgow | 0 | 0 | 4 | 0 | 10 |
| Kew | 24 | 0 | 0 | 3 | 3 |
| Stonyhurst | 0 | 0 | 0 | 0 | 0 |
| Valencia | 3 | 3 | 0 | 0 | 0 |

The Committee then adjourned.

116, *Victoria Street, July* 6, 1869.

PRESENT:

General Sabine in the Chair.

| | |
|---|---|
| The Hydrographer. | Mr. Gassiot. |
| Dr. W. A. Miller. | Mr. Spottiswoode. |
| Mr. De La Rue. | Mr. Galton. |

The Director and the Secretary to the Committee were in attendance.

The Minutes of the last meeting were read and confirmed.

Mr. Galton submitted the model of the copying stage of a pantograph designed by himself (Minutes, June 22).

Read—A letter from Herr Wagner, of Berlin, containing an estimate for a pantograph for copying meteorological curves, in accordance with the requirements of the Committee, as explained to him by Mr. De La Rue. The estimate amounted to 170*l.*; but it was thought that possibly some further apparatus might be required, and it was therefore—

Resolved—To expend a sum not exceeding 200*l.* in purchasing a pantograph.

Mr. Galton was requested kindly to order and undertake the superintendence of the construction of a pantograph, and the sum of 200*l.* was placed at his disposal for that object.

The draft Report of the Office for the year 1868, which had been distributed to the members of the Committee, was approved, subject to corrections from the members of the Committee, to be sent in forthwith.

Mr. Scott was authorized to submit the Report to the Board of Trade for presentation to Parliament.

Mr. Scott and Mr. Stewart reported that M. Hervè Mangon, on his recent visit to London with M. Dumas, had called at the office and also at Kew Observatory, with Mr. De La Rue, and had requested to be furnished with information as to the various departments superintended by the Committee, which had accordingly been given to him.—Approved.

Read—A letter from Captain Toynbee respecting his paper on isobaric curves (Minutes, 1869, p. 1).

The Hydrographer offered some observations on the subject, and it was—

Resolved—That the Committee take into their reconsideration Captain Toynbee's paper on isobaric curves, presented October 26, 1868, with the view to decide whether the time has arrived when, either in its original or modified condition, it might be printed as an accompaniment to Captain Toynbee's second paper, authorized to be printed on the 7th of June.

The subject was referred to Captain Richards and Dr. Miller, with authority to order the publication if approved.

Resolved—That in future the papers published by the Committee shall be distinguished into two series, viz.:—1. *Official;* 2. *Non-official;* and that each paper shall be numbered in succession according to the series to which it belongs.

Mr. Scott submitted an application from the Rev. W. Kirby (Secretary to the South American Missionary Society), for a set of instruments for the mission station just established in Terra del Fuego.

Conditional authority was given to Mr. Scott to issue the instruments if it seemed proper to him to do so, after Mr. Bridges, the proposed observer, should have called on him.

Mr. Scott submitted the sea-surface temperature charts for the South Atlantic Ocean (Minutes, 1869, p. 53), which had just been received from Her Majesty's Stationery Office.

Mr. Scott reported that on the 1st inst. he had applied to the Treasury for a further imprest of 2,000*l.*, which he had received, and had lodged to the credit of the Committee in the Bank of England.

He also reported that in order to meet the cheques drawn for the June accounts he had withdrawn a sum of 1,000*l.* from the deposit account at the London and Westminster Bank, on the signature of the Chairman, and had lodged it in the Bank of England on the 29th ult.

Resolved—That a cheque for 1,000*l.* be drawn on the Bank of England, and that it be lodged in the London and Westminster Bank to the credit of the deposit account of the Committee.

ACCOUNTS PAID, AND LIABILITIES.

| | Paid. | Estimated Liabilities. |
|---|---|---|
| | £ s. d. | £ s. d. |
| Salaries | 785 9 8 | — |
| Instruments, Mercantile Marine | 8 13 10 | 73 0 0 |
| „ Admiralty | 29 10 4 | 39 0 0 |
| Agencies at Ports | 18 12 6 | 4 0 0 |
| Travelling | 3 19 9 | — |
| Telegraphy | 546 14 0 | 225 0 0 |
| Observatories, Current Expenses | 503 12 9 | 50 0 0 |
| „ Outfit | 52 10 10 | 155 0 0 |
| Special Printing | 33 15 3 | 3 0 0 |
| Contingencies | 751 7 7 | 237 0 0 |
| Totals | 2,734 6 6 | *786 0 0 |

Grand total - 3,520*l.* 6*s.* 6*d.*

Correct to 30th June 1869.

ROBERT H. SCOTT.

Mr. Scott reported that the following cheques had been drawn on the 28th June by the Chairman:—

| For Salaries for June: | £ s. d. |
|---|---|
| R. H. Scott | 66 13 4 |
| H. Toynbee | 33 6 8 |
| B. Stewart | 33 6 8 |
| W. Salmon | 18 6 8 |
| J. S. Harding, jun. | 14 3 4 |
| R. Strachan | †16 13 4 |
| S. Jeffery (5 weeks, to 30th) | 15 0 0 |
| F. Gaster | 10 16 8 |
| C. Harding | 9 3 4 |
| R. H. Curtis | 7 10 0 |
| F. Steventon | 6 13 4 |
| J. S. Harding, sen. (5 weeks, to 30th) | 9 12 6 |
| E. Magrath (4½ „ „) | 5 12 6 |
| A. D. Spencer (4½ „ „) | 5 12 6 |
| J. Curtis (4½ „ „) | 5 12 6 |
| J. H. Jeayes (4⅓ „ „) | 5 8 4 |
| W. G. James (4½ „ „) | 5 8 4 |
| G. Francis (4½ „ „) | 3 7 6 |
| G. Brodie (4½ „ „) | 3 7 6 |
| Carried forward | 275 15 0 |

* Out of this sum 50*l.* has been *advanced* to Mr. Kerr (Valencia), and 150*l.* has been advanced for office fittings.

† Including allowance for care of instruments.

| | £ s. d. | £ s. d. |
|---|---|---|
| Brought forward - - - | - | 275 15 0 |
| For Instruments: | | |
| L. P. Cassella { M.O. account - - - | 7 4 0 | |
| A. account - - - | 25 4 0 | |
| | 32 8 0 | |
| For Agencies: | | |
| J. R. Jones, Aberdeen - - - - | - | 4 5 9 |
| For Telegraphy: | | |
| Electric Telegraph Company, May - - | - | 59 12 8 |
| Magnetic " " " - - - | - | 55 3 7 |
| Submarine " " " - - - | - | 30 8 7 |
| Anglo-American Company, allowance to Heart's Content, 6 months - - - - | - | 6 10 0 |
| For Observatories, &c.: | | |
| David Thomson, Aberdeen— | | |
| Allowance for quarter - - - - | 62 10 0 | |
| Accounts for fittings, &c. - - - | 9 17 6 | |
| Postages and sundries - - - - | 4 16 9 | |
| | 77 4 3 | |
| T. R. Robinson, Armagh— | | |
| Allowance for quarter - - - - | 28 15 0 | |
| Account for expenses - - - - | 10 3 3 | |
| | 38 18 3 | |
| W. P. Dymond, Falmouth— | | |
| Allowance for quarter - - - - | - | 66 5 0 |
| R. Grant, Glasgow— | | |
| Allowance for quarter - - - - | - | 62 10 0 |
| B. Stewart, Kew— | | |
| Allowance for quarter - - - - | 112 10 0 | |
| Expenses at Armagh, Orkney, &c. - - | 38 17 1 | |
| | 151 7 1 | |
| S. J. Perry, Stonyhurst— | | |
| Allowance for quarter - - - - | - | 50 0 0 |
| T. Kerr, Valencia— | | |
| Salary for June - - - - | - | 20 16 8 |
| J. Driscoll, six months' rent of Valencia Observatory | - | 25 0 0 |
| T. Weeks, repairs to leather cases - - - | - | 0 14 0 |
| Messrs. Beck, pantograph - - - - | 7 7 0 | |
| Fittings to Valencia anemograph - - | 4 15 0 | |
| | 12 2 0 | |
| For printing (books, &c.): | | |
| Trübner & Co., books - - - - | - | 3 0 0 |
| R. J. Bush, book covers - - - - | - | 2 11 4 |
| For Contingencies: | | |
| J. J. Bishop, removing Presses and Office Effects - | - | 18 0 0 |
| W. G. Schoof, Timepieces - - - - | - | 7 16 0 |
| Priest Brothers, Furniture - - - - | - | 240 7 8 |
| C. Dunning, Office Fittings - - - | - | 87 3 6 |
| J. H. Parsons, Rent, &c., for quarter - - | 93 2 6 | |
| " " Stamps for Agreement - - | 4 7 0 | |
| | 97 9 6 | |
| George Taylor, Gas Fittings, &c. - - - | - | 34 10 0 |
| R. H. Scott, Extra Work of Staff - - - | - | 63 3 9 |
| F. Gaster, Extra Work - - - - | - | *10 5 0 |
| For Office Petty Expenses: | | |
| J. S. Harding, jun., on account - - - | - | 30 0 0 |
| Total - - - | - | £1,563 7 7 |

* This cheque was drawn on the 14th.

A cheque was drawn in favour of Mr. J. S. Harding, on account for office expenses, 15*l.*

Mr. Stewart stated his intention of visiting the Observatories of Stonyhurst, Glasgow, and Aberdeen before the meeting of the British Association, and the other observatories immediately after that meeting.

He was instructed to inspect the neighbourhood of the various observatories, in order to find, if possible, a place suitable for a raingauge, when an instrument of this nature shall have been approved by the Committee.

The Committee then adjourned.

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116, *Victoria Street, July* 19, 1869.

PRESENT:

General Sabine in the Chair.

Mr. Gassiot. | Captain Richards.

Mr. Spottiswoode.

The Director was in attendance.

The Minutes of the last meeting were read, compared, and signed.

Mr. Scott presented the following report of his inspection of the telegraphic reporting stations at Penzance, Plymouth, and Portsmouth :—

REPORT.

Meteorological Office, 116, Victoria Street,
London, S.W., July 12. 1869.

GENTLEMEN,

*Penzance.*—I inspected the station at Penzance on the 8th inst. I found the clerk, Mr. J. Senior, very intelligent and attentive.

The barometers were in good order.

The thermometers were clean, but they were still in their old situation, under the roof of the railway station, Mr. Gill, the former clerk, having left Penzance without carrying out the change of situation for these instruments referred to in my last report.

The register was well and regularly kept.

*Plymouth.*—I inspected this station on the 9th inst. I regret to say that it was in an unsatisfactory condition. The instruments were very dirty, and the wet bulb thermometer was very badly managed, its readings being nearly worthless.

The register was carelessly kept.

I have drawn Mr. Pinchin's attention to these matters, and I hope they will be set straight in future.

*Portsmouth.*—I visited this station on the 10th inst. I found everything in good order, Mr. Hardy taking a great interest in the subject. The only matter requiring amendment was the wet bulb thermometer, the mounting of which had not been cleaned sufficiently frequently.

I have in addition to state that I have made arrangements for the posting up at the various drum signal stations on the south coast of the actual telegrams conveying the telegraphic weather intelligence issued by the office.

ROBERT H. SCOTT.

It was resolved—That Mr. Scott should be instructed to take measures to have the telegrams posted up at all drum stations whenever the drum is up.

Read—A suggestion from Capt. Toynbee that he should be permitted to have circulars lithographed, announcing that the Committee were resuming the collection of observations at sea, especially in the Pacific Ocean, and inviting intending observers to call on him.

Approved.

Mr. Scott requested permission, in case he found it practicable to do so, to establish a telegraphic reporting station at Wick in the course of the ensuing autumn. The expense of such a station he estimated at about 70*l.* per annum.

Authorized.

Mr. Scott submitted his report to the Committee on the connexion between strong winds and barometric differences (Minutes 1868, p. 35), and requested permission to have it now reprinted without the tables, for publication as No. 1. of the Non-official Publications of the Office, *vide* Minutes of last meeting.

Approved.

Mr. Scott reported that several barometers which had been recently repaired had been rejected on their examination at Kew, and that fees had been charged by the Kew Committee for such examination.

It was resolved—That in future the fees for verification of rejected instruments be deducted from the amounts payable by the office to the respective makers.

Mr. Scott stated that the Meteorological Commission of France had supplied to the office the bulletin from their newly-established observatory at Montsouris, near Paris, daily since the 1st instant.

Resolved—That as soon as the balance of the annual grant to the office, 6,000*l.*, shall have been received from the Treasury, the sum of 5,000*l.* should be deposited in the London and Westminster Bank, and 1,000*l.* should be lodged to the current account of the Committee in the Bank of England.

The Committee then adjourned.

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116, *Victoria Street, Monday, October* 11, 1869.

PRESENT:

Sir E. Sabine in the Chair.

| | |
|---|---|
| Mr. De La Rue. | Captain Richards. |
| Mr. Galton. | Mr. Gassiot. |

Dr. W. A. Miller.

The Director and the Secretary to the Committee were in attendance.

The Minutes of the last meeting were read and confirmed.

The Director submitted the following Report:—

GENTLEMEN,

I HAVE to report that I have completed the inspection of all the telegraphic reporting stations.

*Liverpool.*—Visited July 29th. The station is in good order and is satisfactory in all respects except as regards the thermometrical readings. I have reason to hope that a new situation may be found for the thermometers, where a free exposure may be attained.

*Scarborough.*—Visited July 30th. This station is quite satisfactory.

*North Shields.*—Visited July 31st. The station is not altogether satisfactory. The clerk was changing his residence on the day of my visit, and in his new premises there was no fitting situation for the thermometers. I therefore instructed him to apply for permission to have them erected in an open space called Dockwray Square. This he has fortunately been able to obtain, and the change will be at once carried out. I hope that considerable improvement will be noticed in his reports in future.

*Leith.*—Visited August 2nd.
*Nairn.*—Visited August 20th.
*Aberdeen.*—Visited August 23rd.
} These stations were all in very good order in all respects.

*Wick.*—Visited August 24th. In accordance with your resolution of the 19th July, I despatched a set of instruments to Wick, and on my arrival at the town I called on Mr. Cox, the Collector of Customs with the view of finding an observer. By Mr. Cox's advice I entrusted them to Mr. J. Sandison, the post-master, who has undertaken the duty. He is, by occupation, a ship-broker, and is very intelligent. I have no doubt that he will make a good reporter. He commenced to report on the 8th of September.

*Thurso.*—I visited this town from Wick in order to see its fitness for a meteorological station in case the committee thought fit to adopt it as a check station to Wick. I saw Mr. Waters, the Customs Officer at Scrabster Pier, who gave me every assistance. His own house is not well suited for a station, being under a high bank with a hill behind, but he has promised to let me know whether there is any one in Thurso competent to furnish the reports. The town itself would make a good station, as the country about it is very level, as is the whole of Caithness.

*Ardrossan.*—Visited September 1st. This station is in very good order.

*Greencastle.*—Visited September 6th. I am sorry to say that this station is not in a satisfactory state, as the clerk seemed careless about keeping his register. This may be partly attributable to the fact that he was absent on leave when I went to Greencastle in 1868, so that he may possibly have misunderstood the directions left for him by me. I hope that now there will be no further fault to find.

*Holyhead.*—Visited September 16th.
*Roche's Point.*—Visited September 20th.
} Both these stations are in very good order.

*Cape Clear.*—Visited September 23rd. This station is in fair order. The thermometers were not quite screened from the sun in the early morning hours, and the use of the minimum thermometer was not thoroughly understood. These matters will now be set right.

*Valencia.*—Visited September 25th. This station is in good order.

*St. Ann's Head.*—Pembroke. Visited October 1st. This station is extremely well placed, having a better exposure to wind points than any other which we have. Mr. Walker the clerk has sent very good reports ever since March 1st, when he began to observe. His instruments are clean and in good order.

On the whole I am glad to say that I found the stations generally in a very satisfactory condition; the reporters are interested in their work, and the private registers have been in most instances well kept.

ROBERT H. SCOTT.

P.S. In addition to the work of inspecting the stations, I transacted some other business in the course of my tour. At Liverpool and Shields I made inquiries respecting the semaphores, but was unable to obtain *definite* information as to their utility and popularity. I would venture to suggest to the Committee that some action might be taken to elicit opinions on these subjects. At Campbeltown, in Cantyre, I found a set of instruments which had been recovered in the year 1857 from the wreck of the ship "Charlemagne." The barometer had been set up by Mr. Hicks, the Collector of Customs, for the use of the public, in accordance with permission granted by Admiral FitzRoy in the year 1859. As Mr. Hicks did not use the thermometers or hydrometers, I gave him a receipt for them, and instructed him to have the barometer erected on the quay instead of at the Custom House, which is situated at some little distance from the harbour.

*Aberdeen.*—I called on the provost, Mr. Nicoll, with reference to the instruments at the grammar school (Minutes, pp. 5 and 9), and obtained permission for their restitution, on the condition that a set be supplied to the navigation school for instruction of the sea-faring portion of the population. These instruments have been sent in.

Resolved—That the Committee approve of the establishment of a reporting station at Thurso, provided a suitable observer can be found.

Mr. Scott was instructed to ascertain from the parties interested whether there would be any objection to taking down the semaphores erected at Blackwall, Liverpool, and North Shields.

The erection of the barometer on the Quay, at Campbeltown, for the use of the fishermen, was approved.

The grant of a set of instruments for use at the Navigation School, Aberdeen, was approved.

The Secretary presented the following report of his visit to the various meteorological observatories:—

*Stonyhurst* was visited on July 28th. Everything seemed in order at this observatory, and there is nothing to note.

*Glasgow* was visited on July 29th. The anemometer appeared to be slightly wrong in its orientation, in consequence of which at eight minutes past noon the direction pencil was unfastened, and pushed about one point from east towards south. There is nothing else to note.

*Aberdeen* was visited on July 31st. Everything seemed to be in order. Should the Committee adopt a self-recording rain gauge for the various observatories, the most suitable position for the Aberdeen instrument of this kind would appear to be a lawn connected with the official residence of the Professor of Natural Philosophy.

*Falmouth* was visited on August 27th. All the instruments seemed to be working well. I suggested a slightly different arrangement of the gas tube in the barograph room, in order to afford the means of carrying off easily any water that might lodge in the pipe.

The opening of a window in this room would, I think, be an improvement as regards ventilation, and the cost would not exceed 3*l*.

If the Committee decide on a self-recording rain gauge, the Polytechnic Institution will endeavour, if possible, to get an eligible piece of ground near the observatory; at any rate such may be had a little distance off.

*Valencia* was visited on September 3rd. Everything appears to be in good order. I suggested that the instrumental clocks might be cleaned before winter, as they would appear, from what Mr. Kerr says, to require this.

*Armagh* was visited on September 7th. Dr. Robinson was unfortunately from home. Everything appears to be in good order. The ventilator suggested at my last visit has been attached to the top of the thermograph frame.

It would appear that the bagging of the barograph curve may be caused by the fact that the sensitive paper when attached to the cylinder is in a different hygrometric state from that which it acquires in the barograph room. In order to test this, I have authorized Mr. Call (Dr. Robinson's assistant) to procure a wooden frame in which the sensitive paper may remain in the barograph room for a day before it is attached to the cylinder.

Resolved—That Mr. Stewart be authorized to make arrangements with Dr. Robinson for the anemometrical record at Armagh being rendered comparable with the other instruments in its indications.

Resolved—That Mr. Stewart be authorized to have a window opened in the Falmouth barograph room, cost not to exceed 3*l*.

The Secretary presented the following report regarding the records for June, July, and August 1869, received from the self-recording instruments of the various observatories, and which have been examined at Kew in accordance with the regulations adopted by the Meteorological Committee. (See Minutes, 21st December 1868.)

## JUNE.

### Anemograph.

*Aberdeen.*—The anemograph at this station has been in good action during the month. The orientation was tested on June 19th, 11.30 a.m., and found correct. No error in tabulation has been discovered at Kew. The records are quite complete.

Forty remeasurements of direction and velocity have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 2·0 | 2·0 |
| (2.) Mean difference irrespective of sign | 0·3 | 0·8 |
| (3.) Residual difference (Aberdeen−Kew) | −0·1 | +0·4 |

*Armagh.*—The anemograph at this station has been in good action during the month. The records are quite complete with the exception of one hour's record of velocity at 11 a.m. on June 27th. No error in tabulation has been discovered at Kew.

Forty remeasurements of direction and velocity have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·5 | 2·5 |
| (2.) Mean difference irrespective of sign | 0·4 | 0·6 |
| (3.) Residual difference (Armagh−Kew) | +0·2 | +0·1 |

*Falmouth.*—The anemograph at this station has been in good action during the month. The records are quite complete. The orientation was tested on June 10th and found correct. No error in tabulation has been discovered at Kew.

Forty remeasurements of direction and velocity have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign | 0·1 | 0·5 |
| (3.) Residual difference (Falmouth−Kew) | −0·1 | +0·2 |

*Glasgow.*—The action of the anemograph at this station has been somewhat faulty during the month, owing to some defect in the recording pencils. On June 2, at 4 a.m. and 5 a.m., the velocity pencil appears to have stopped, in consequence of which two hourly values for velocity are rendered doubtful. The records are otherwise complete. The orientation was tested on June 9th and found correct. No errors of tabulation have been discovered at Kew.

Forty remeasurements of direction and velocity have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign | 0·2 | 0·5 |
| (3.) Residual difference (Glasgow−Kew) | 0·0 | 0·0 |

*Kew.*—The anemograph at this station has been in good action during the month. The instrument, however, was not started until 11.30 a.m. on June 1st, in consequence of a leakage in the roof being attended to; owing to this one hour's record both for velocity and direction was lost. The records are otherwise complete. The orientation was tested on June 1st and found correct. No error in tabulation has been discovered at Kew.

Forty remeasurements of direction and velocity have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 1·0 |
| (2.) Mean difference irrespective of sign | 0·1 | 0·7 |
| (3.) Residual difference ($Kew^1$−$Kew^2$) | 0·0 | +0·1 |

*Stonyhurst.*—The anemograph at this station has been in good action during the month. The records are quite complete. The following error in velocity was discovered on June 9th, at 11 a.m., viz., 14 miles should have been 24; this was put right. The orientation was tested on June 15th and found correct.

Forty remeasurements of direction and velocity have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign | 0·2 | 0·6 |
| (3.) Residual difference (Stonyhurst−Kew) | −0·1 | 0·0 |

*Valencia.*—The anemograph at this station has been in good action during the month, excepting that the direction traces are somewhat defective in places. In consequence of oiling the wheels, &c. on June 1st at 11 a.m., one hour's record of direction has been lost. The records are otherwise complete. The orientation was tested on June 16th and found correct. No errors of any consequence have been discovered at Kew.

Forty remeasurements of direction and velocity have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign | 0·1 | 0·7 |
| (3.) Residual difference (Valencia−Kew) | −0·1 | 0·0 |

## Barograph.

*Aberdeen.*—The action of the Aberdeen barograph, as well as the photography, have been good during this month. The records are quite complete. No errors have been detected at Kew.

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0050 |
| (2.) Mean difference irrespective of sign | 0·0021 |
| (3.) Residual difference (Aberdeen—Kew) | +0·0009 |

The mean monthly difference between simultaneous barograph and standard readings is 0·0016.

*Armagh.*—The action of the Armagh barograph, as well as the photography, have been good during this month, excepting that some of the sheets are somewhat discoloured. In consequence of the trace not being sufficiently developed on June 4th at 11 a.m. the hourly value is lost. The records are otherwise complete. There is still a bend at the commencement of each sheet.

The following errors have been detected and put right:

In calculating residual correction—

| | | | |
|---|---|---|---|
| June 12, 11 a.m. to mid. | +·011 | should be | +·010 |
| „ 13, 1 a.m. to 14, 10 a.m. | +·011 | „ | +·010 |
| „ 15, 11 a.m. to 16, 10 a.m. | +·019 | „ | +·020 |
| „ 23, 11 a.m. to 24, 10 a.m. | +·002 | „ | +·001 |
| „ 25, 11 a.m. to 26, 10 a.m. | 014 | „ | 013 |

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0060 |
| (2.) Mean difference irrespective of sign | 0·0017 |
| (3.) Residual difference (Armagh—Kew) | +0·0011 |

The mean monthly difference between simultaneous barograph and standard readings is 0·0025.

*Falmouth.*—The action of the Falmouth barograph has been good during this month. Two of the photograph traces are somewhat faint and a few of the sheets slightly discoloured; the remainder are good. There was a failure of gas from June 29, 11 p.m., to 30,9 a.m., in consequence of which 10 hourly values have been lost, also owing to a photographic blemish on June 14, 11 a.m., one hourly record is lost. In all 11 hourly values have been lost. The records are otherwise complete.

The following errors have been detected and put right:

In entry of standard readings—

29·657 should be 29·757

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0070 |
| (2.) Mean difference irrespective of sign | 0·0024 |
| (3.) Residual difference (Falmouth—Kew) | —0·00014 |

The mean monthly difference between simultaneous barograph and standard readings is 0·0018.

*Glasgow.*—The action of the Glasgow barograph has been good during this month, excepting occasional failures of the action of clock stop on curve 180–181. The photography has been good, and the records are quite complete.

The following errors have been detected and put right:

In calculating residual correction—

| | | | |
|---|---|---|---|
| June 1, 11 a.m. to 2·10 a.m. | +·014 | should be | +·016 |
| „ 2, 11 a.m. to 3·10 a.m. | +·009 | „ | +·007 |

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0060 |
| (2.) Mean difference irrespective of sign | 0·0019 |
| (3.) Residual difference (Glasgow—Kew) | +0·0012 |

The mean monthly difference between simultaneous barograph and standard readings is 0·0026.

*Stonyhurst.*—The action of the Stonyhurst barograph has been good during the month; the photography has also been good, excepting for sheet 158–159, and also the trace of 180–181 is too indistinct to be measured with the tabulating instrument, but measurements have been made at Kew to the nearest hundredth. The records are complete.

The following errors have been detected and put right:

In calculating residual correction—

| | | | |
|---|---|---|---|
| June 9, 11 a.m. to 10, 10 a.m. | +·008 | should be | +·007 |
| „ 17, 11 a.m. to 18, 10 a.m. | +·014 | „ | +·011 |

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0070 |
| (2.) Mean difference irrespective of sign | 0·0024 |
| (3.) Residual difference (Stonyhurst—Kew) | +0·0011 |

The mean monthly difference between simultaneous barograph and standard readings is 0·0020.

*Kew.*—The action of the Kew barograph, as well as the photography, have been good during the month. There were, however, several failures of the gas. June 1, 1 a.m. to 4 a.m., in consequence of gas failing, four hourly values have been lost; also June 6, 11 p.m. to 7 10 a.m., ten hourly values have been lost; June 8, 2 a.m. to 9 a.m., also 8 p.m. and 9 p.m., ten hourly values have been lost; June 7, 10 p.m.,

gas failed, and June 8, 10 p.m., but standard readings of the barometer having been taken at these hours, the hourly values are not lost. In all 24 hourly values have been lost. The records are otherwise complete.

The following errors have been discovered and put right:

In calculating residual correction—

June 7, 11 a.m. to 8, 10 a.m. −·020 should be −·025

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference - - - - | 0·0040 |
| (2.) Mean difference irrespective of sign - - | 0·0016 |
| (3.) Residual difference (Kew[1]−Kew[2]) - - | +0·0010 |

The mean monthly difference between simultaneous barograph and standard readings is 0·0019.

*Valencia.*—The action of the Valencia barograph has been good during this month. The photography has also been good, but traces Nos. 176–177 and 180–181 are faint. The records are quiite complete.

The following errors have been detected and corrected:

In entry of standard readings—

June 29, 4 p.m., 30·144 should be 30·244
„ 30, 10 p.m., 30·351 „ 30·251

In calculating residual correction—

| | | | |
|---|---|---|---|
| June 12, 11 a.m. to midt. | −·013 | should be | −·012 |
| „ 13, 1 a.m. to 10 a.m. | −·013 | „ | −·012 |
| „ 13, 11 a.m. to 14,10 a.m. | −·013 | „ | −·012 |
| „ 18, 11 a.m. to 19,10 a.m. | −·021 | „ | −·019 |
| „ 27, 11 a.m. to 28,10 a.m. | −·027 | „ | −·022 |

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference - - - - | 0·0050 |
| (2.) Mean difference irrespective of sign - - | 0·0017 |
| (3.) Residual difference (Valencia−Kew) - - | +0·0012 |

The mean monthly difference between simultaneous barograph and standard readings is 0·0017.

## Thermograph.

*Aberdeen.*—The Aberdeen thermograph has been in good action during June, and the photography has been good.

The traces for both bulbs are quite complete.

One or two slight errors have been discovered and corrected, as follows:

In entry of standard reading—

Wet bulb, 4, 10 a.m., 47·6 should be 46·6
„ 8, 8 p.m., 48·0 „ 47·8
Dry bulb, 9, 10 a.m., not entered in tabulation sheet.

Only one error in tabulation was discovered, viz.:

Wet bulb, 2nd, 3 p.m., 53·4 should be 54·0

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| Greatest difference - - - - - | 0·4 | 0·3 |
| Mean difference irrespective of sign - - - | 0·13 | 0·13 |
| Residual difference (Aberdeen−Kew) - - | 0·0 | +0·04 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·11 | 0·13 |

*Armagh.*—The Armagh thermograph has been in good action during June, and the photography has also been good. The traces for both bulbs are quite complete.

The following errors in tabulation have been discovered and corrected, viz.:

| | | | |
|---|---|---|---|
| Dry bulb, 13, 2 p.m., | 54·0 | should be | 53·0 |
| „ 15, 5 p.m., | 53·0 | „ | 52·0 |
| „ 16, 11 p.m., | 49·0 | „ | 48·2 |
| „ 15, 3 a.m., | 45·4 | „ | 44·5 (discovered by remeasurement at Kew.) |
| Wet bulb, 16, midt., | 50·0 | „ | 51·2 |

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign - - | 0·12 | 0·10 |
| (3.) Residual difference (Armagh−Kew) - - | −0·01 | −0·01 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| ·16 | ·16 |

*Falmouth.*—The Falmouth thermograph has been in good action during June, and the photography has also been good. The traces for the dry bulb are quite complete. The wet bulb curve was very faint from 11 a.m. till 4 p.m. and at 7 and 8 p.m. on 6th, by which eight hourly records have been lost. The wet bulb was not in proper action for some hours on several days during the month, so that 10 hourly records of this instrument have been lost from this cause, and two have their values marked doubtful from the same. In all 20 hourly records of the wet bulb have been lost. The wet bulb records are otherwise complete.

No errors have been discovered.

Forty remeasurements have been made at Kew with the following results:

| | Wet. | Dry. |
|---|---|---|
| Greatest difference - - - - - | 0·4 | 0·3 |
| Mean difference irrespective of sign - - - | 0·14 | 0·11 |
| Residual difference (Falmouth—Kew) - - - | −0·02 | +0·07 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| ·11 | ·11 |

*Glasgow.*—The Glasgow thermograph has been in good action during June, and the photography has also been good. The dry bulb records are quite complete. The wet bulb readings at 7 and 8 p.m. on 18th are marked doubtful, owing to there not being sufficient water to the bulb; it was also out of action from 5 till 8 p.m. on the 30th from the same cause. Six hourly records have thus been lost. The wet bulb records are otherwise complete.

No errors have been discovered.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| Greatest difference - - - - - | 0·4 | 0·4 |
| Mean difference irrespective of sign - - - | 0·14 | 0·14 |
| Residual difference (Glasgow—Kew) - - - | −0·08 | −0·09 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| ·12 | ·12 |

*Kew.*—The Kew thermograph has been in good action during June, and the photography has also been good. The dry bulb traces are quite complete. The wet bulb was out of action from 5 till 10 p.m. on 15th, by which five hourly records have been lost. The wet bulb records are otherwise complete. The instrument was thoroughly examined on the 8th at 11 a.m., all the bulbs were cleared from dust, &c., and new muslin coverings were put to the wet bulbs.

No errors have been discovered.

Forty remeasurements have been made with the following results:

| | Dry. | Wet. |
|---|---|---|
| Greatest difference - - - - - | 0·2 | 0·2 |
| Mean difference irrespective of sign - - - | 0·06 | 0·04 |
| Residual difference ($Kew^1 - Kew^2$) - - - | −0·02 | −0·02 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| ·08 | ·09 |

*Stonyhurst.*—The Stonyhurst thermograph has been in good action during the month of June, and the photography has also been good. The traces for both bulbs are quite complete. Only one error in tabulation has been discovered and corrected as follows:

Dry bulb, 29th, 7 a.m, 43·5 should be 53·5.

There are no other errors of any consequence.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| Greatest difference - - - - - | 0·3 | 0·4 |
| Mean difference irrespective of sign - - - | 0·13 | 0·16 |
| Residual difference (Stonyhurst—Kew) - - | +0·05 | +0·02 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·12 | 0·12 |

*Valencia.*—The Valencia thermograph has been in good action during June, and the photography has also been good. The traces for both bulbs are quite complete. The wet bulb was retabulated from 27th, 1 a.m., till 10 a.m. on the 28th, as the first tabulations were made from setting the scale to an incorrect standard.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| Greatest difference - - - - - | 0·3 | 0·3 |
| Mean difference irrespective of sign - - - | 0·07 | 0·08 |
| Residual difference (Valencia—Kew) - - - | −0·02 | −0·02 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| ·14 | ·17 |

In the following Table the number of hourly records lost during the month of June is exhibited.

| | Anemograph. | | Barograph. | Thermograph. | |
|---|---|---|---|---|---|
| | Direction. | Velocity. | | Dry. | Wet. |
| Aberdeen - - - - - | 0 | 0 | 0 | 0 | 0 |
| Armagh - - - - - | 0 | 1 | 1 | 0 | 0 |
| Falmouth - - - - - | 0 | 0 | 11 | 0 | 20 |
| Glasgow - - - - - | 0 | 2 | 0 | 0 | 6 |
| Kew - - - - - | 1 | 1 | 24 | 0 | 5 |
| Stonyhurst - - - - - | 0 | 0 | 0 | 0 | 0 |
| Valencia - - - - - | 1 | 0 | 0 | 0 | 0 |

## JULY.

### Anemograph.

*Aberdeen.*—For the first part of the month the action of the direction pencil appears to have been somewhat stiff, and several calms appear in the velocity trace. I am unable to say whether these may not have been caused by a slight amount of stiffness in the pencil, or whether they are natural phenomena.

On account of insufficient pressure of pencil the velocity and direction for 11 a.m. of July 25th were both lost.

No error of consequence has been discovered at Kew.

Forty remeasurements of direction and velocity have been made with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference - - - | 2·0 | 2·0 |
| (2.) Mean difference irrespective of sign - | 0·2 | 0·8 |
| (3.) Residual difference (Aberdeen—Kew) | 0·0 | +0·2 |

*Armagh.*—The anemograph has been in good action during the month of July, and the records are complete with the following exceptions: Six hourly records of both velocity and direction were lost on July 6th, on account of stoppage of clock; and 11 hours both of velocity and direction on July 31st from the same cause; also one hour of velocity appears untabulated on July 4th, and one hour on July 9th. No errors in tabulation have been discovered at Kew.

Forty remeasurements have been made with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference - - - - | 1·0 | 1·0 |
| (2.) Mean difference irrespective of sign - - | 0·4 | 0·3 |
| (3.) Residual difference (Armagh—Kew) - | +0·1 | 0·0 |

*Falmouth.*—The anemograph at this station has been in good action in the month of July, and there are no blanks. No error has been discovered at Kew.

Forty remeasurements of direction and velocity have been made with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference - - - | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign - | 0·2 | 0·9 |
| (3.) Residual difference (Falmouth—Kew) | 0·0 | +0·2 |

*Glasgow.*—During the whole of this month the direction pencil fails to mark in places for the space of about five minutes, and the velocity pencil appears occasionally to move abruptly; the cause is probably due to flexure of the shafts, which are somewhat long. The clock having run down at 5.30 a.m. on the 9th, five hourly traces both of velocity and direction have been lost.

On July 29th at 0h. 8m. p.m. the direction pencil was shifted one point from east towards south in order to make it right.

The following error in velocity has been detected at Kew, July 10th, 11 a.m., 19 should be 24.

Forty remeasurements of direction and velocity have been made with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference - - - | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign - | 0·2 | 0·6 |
| (3.) Residual difference (Glasgow—Kew) | 0·0 | +0·1 |

*Kew.*—The Kew anemograph has been in good action during this month. There are no blanks and no error has been discovered.

Forty remeasurements of direction and velocity have been made with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference - - - | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign - | 0·1 | 0·5 |
| (3.) Residual difference ($Kew^1$—$Kew^2$) - | +0·1 | —0·05 |

*Stonyhurst.*—The anemograph has been in good action during the month of July, nevertheless the direction pencil has been somewhat faint. Curve No. 212 was partially obliterated through getting wet, but being still readable was tabulated at Kew.

On account of the instrument not having been started at 11 a.m. on 31st, the traces of direction and velocity are lost for that hour.

One or two small errors in velocity have been discovered at Kew and put right. The orientation was tested on July 17th and found correct.

Forty remeasurements of direction and velocity have been made with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 2·0 | 2·0 |
| (2.) Mean difference irrespective of sign | 0·3 | 0·7 |
| (3.) Residual difference (Stonyhurst—Kew) | —0·1 | —0·3 |

*Valencia.*—The Valencia anemograph has been in good action during the month of July. The orientation was tested on the 1st and found correct. The records are quite complete. Several small errors in velocity have been discovered and put right.

Forty remeasurements of direction and velocity have been made with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign | 0·2 | 0·7 |
| (3.) Residual difference (Valencia—Kew) | —0·1 | +0·1 |

## Barograph.

*Aberdeen.*—The action of the barograph for July has been good, but the sheets have been somewhat discoloured. In consequence of the failure of the gas one hourly record has been lost on July 4th, and four on July 5th. No errors of any consequence have been discovered at Kew.

Forty remeasurements have been made at Kew, with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0060 |
| (2.) Mean difference irrespective of sign | ·0017 |
| (3.) Residual difference (Aberdeen—Kew) | +·0003 |

The mean monthly difference between simultaneous barograph and standard readings is 0·0020.

*Armagh.*—The action of the Armagh barograph, as well as the photography, have been good, except that there is still bagging in the curves, although to a smaller extent than previously. Owing to a failure in the gas, six hourly records have been lost on July 9th, and ten on July 10th.

The following errors have been detected and corrected:

In calculating residual correction—

| | | |
|---|---|---|
| July 17, 11 am. to midnight, | —·012 | should be —·014 |
| „ 18 (morning) | —·012 | „ —·014 |
| „ 18–19 | —·002 | „ —·001 |
| „ 26–27 | +·006 | „ +·004 |
| „ 28–30 | +·008 | „ +·007 |

In applying residual correction—

For the latter part of 10th July +·006 was applied as —·006.

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0060 |
| (2.) Mean difference irrespective of sign | ·0025 |
| (3.) Residual difference (Armagh—Kew) | +0·0002 |

The mean monthly difference between simultaneous barograph and standard readings is 0·0023.

*Falmouth.*—The Falmouth barograph has been in good action during the month of July, but the photography has been deficient; in consequence of this the hourly record for July 16th, 11 a.m., has been lost, and many other readings have only been obtained to the nearest hundredth by means of the subsidiary tabulating instrument.

The following errors have been detected and put right:

In calculating residual correction—

| | | |
|---|---|---|
| July 22–23, | —·012 | should be —·010 |
| „ 27–28, | —·004 | „ —·002 |
| „ 29–30, | —·014 | „ —·013 |

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | ·0050 |
| (2.) Mean difference irrespective of sign | ·0022 |
| (3.) Residual difference (Falmouth—Kew) | +·0008 |

The mean monthly difference between simultaneous standard and barograph readings is ·0024.

*Glasgow.*—The action of the Glasgow barograph, as well as the photography, for the month of July have been good, excepting that the clockstop has not worked regularly.

The records are quite complete.

The following errors have been detected and put right:

In entry of standard barometer—

July 4, 6 p.m., 29·713 should be 29·723.

In calculating residual correction—

| | | | |
|---|---|---|---|
| July | 12–13, | +·011 should be | +·012 |
| „ | 16–17, | +·018 „ | +·016 |
| „ | 18–19, | +·001 „ | +·005 |
| „ | 24 (part) | +·008 „ | +·009 |
| „ | 25–26, | +·008 „ | +·009 |

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0050 |
| (2.) Mean difference irrespective of sign | 0·0024 |
| (3.) Residual difference (Glasgow–Kew) | +0·0004 |

The mean monthly difference between simultaneous standard and barograph readings is ·0015.

*Kew.*—The Kew barograph has been in good action during the month of July, and the photography has been also good.

The records are quite complete.

The following errors have been detected and put right:

In applying residual correction—

| | | | |
|---|---|---|---|
| July | 11, 9 p.m., | 30·231 should be | 30·239 |
| „ | 14, 4 a.m., | 30·070 „ | 30·270 |
| „ | „ 5 a.m., | 30·074 „ | 30·274 |
| „ | 19, 11 a.m., | 30·078 „ | 30·068 |
| „ | 21, 1 a.m., | 30·119 „ | 30·109 |

Forty remeasurements have been made with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0050 |
| (2.) Mean difference irrespective of sign | 0·0014 |
| (3.) Residual difference ($Kew^1$–$Kew^2$) | —·0007 |

The mean monthly difference between simultaneous standard and barograph readings is ·0023.

*Stonyhurst.*—The Stonyhurst barograph has been in good action during the month of July, and the photography has also been good. The records are quite complete.

The following errors have been detected and corrected:

In applying residual correction—

| | | | |
|---|---|---|---|
| July | 25, 9 a.m., | 29·537 should be | 29·534 |
| „ | 28, 3 p.m., | 29·553 „ | 29·563 |
| „ | „ 5 p.m., | 29·540 „ | 29·550 |
| „ | „ 6 p.m., | 29·540 „ | 29·550 |
| „ | „ 8 p.m., | 29·562 „ | 29·572 |
| „ | „ 9 p.m., | 29·566 „ | 29·576 |
| „ | 29, 5 p.m., | 29·390 „ | 29·400 |
| „ | 31, 10 p.m., | 29·490 „ | 29·500 |

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0050 |
| (2.) Mean difference irrespective of sign | ·0019 |
| (3.) Residual difference (Stonyhurst–Kew) | —·0001 |

The mean monthly difference between simultaneous standard and barograph readings is ·0019.

*Valencia.*—The Valencia barograph has been in good action during the month of July, and the photography is good. The records are quite complete.

The following errors have been detected and put right:

In entry of standard reading—

| | | | |
|---|---|---|---|
| July | 3, 4 p.m., | 30·195 should be | 30·095 |
| „ | 10, 10 p.m., | 30·212 „ | 30·312 |
| „ | 20, noon, | 30·185 „ | 30·086 |

In calculation of residual correction—

| | | | |
|---|---|---|---|
| July | 9–10, | —·024 should be | —·023 |
| „ | 10–11, | —·029 „ | —·028 |
| „ | 11–12, | —·021 „ | —·028 |
| „ | 23–24, | —·025 „ | —·023 |

In applying residual correction—

| | | | |
|---|---|---|---|
| July | 16, 7 p.m., | 30·072 should be | 30·076 |
| „ | „ 8 p.m., | 30·071 „ | 30·075 |
| „ | „ 9 p.m., | 30·078 „ | 30·082 |
| „ | „ 10 p.m., | 30·074 „ | 30·078 |
| „ | „ 11 p.m., | 30·074 „ | 30·078 |
| „ | „ midt., | 30·065 „ | 30·069 |
| „ | 29, 10 p.m., | 29·686 „ | 29·786 |
| „ | 30, 7 p.m., | 29·855 „ | 29·851 |

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0060 |
| (2.) Mean difference irrespective of sign | 0·0019 |
| (3.) Residual difference (Valencia—Kew) | +0·0005 |

The mean monthly difference between simultaneous standard and barograph readings is ·0020.

THERMOGRAPH.

*Aberdeen.*—The Aberdeen thermograph has been in good action through July, and the photography is good. The records of the dry bulb are quite complete. On account of gas being low, two hourly records of the wet bulb were lost on July 4th and four on July 5th, and on account of the wetting arrangement being out of action one hourly record was lost on July 6th and another on July 10th. No error of any consequence has been detected at Kew.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·3 | 0·4 |
| (2.) Mean difference irrespective of sign - - | 0·14 | 0·18 |
| (3.) Residual difference (Aberdeen—Kew) - - | +0·06 | −0·02 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·13 | 0·14 |

*Armagh.*—The Armagh thermograph has been in good action through the month of July, and the photography has been good. In consequence of the gas going out six hourly records of both bulbs were lost on July 9th, and ten on July 10th. In addition to this eight hourly records of the wet bulb on July 3rd and nine for July 4th were lost on account of the mirror having been shifted.

The following errors have been detected and put right:

Errors of tabulation—

July 2, 1 p.m., wet bulb, 60·9 should be 61·9
„ 13, 9 a.m., dry bulb, 57·0 „ 56·0
„ 15, 9 a.m., wet bulb, 59·1 „ 60·8
„ 31, 3 p.m., dry bulb, 66·0 „ 65·0
„ „ 5 p.m., „ 62·0 „ 61·0
„ „ 3 a.m., wet bulb, 57·3 „ 57·7

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - - | 0·4 | 0·3 |
| (2.) Mean difference irrespective of sign - - - | 0·16 | 0·14 |
| (3.) Residual difference (Armagh — Kew) - | −0·04 | −0·13 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·20 | 0·18 |

*Falmouth.*—The thermograph has been in good action, but the photography has been defective. On account of faintness of trace three hourly records of dry bulb were lost on July 18th, and from the same cause three hourly records of the wet bulb were lost on July 22nd.

No errors of any consequence have been detected at Kew.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·3 | 0·4 |
| (2.) Mean difference irrespective of sign - - | 0·13 | 0·15 |
| (3.) Residual difference (Falmouth—Kew) - - | −0·10 | +0·02 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·09 | 0·10 |

*Glasgow.*—The thermograph has been in good action in the month of July, and the photography is good. The dry bulb records are quite complete. On account of the wet bulb being out of action two hourly records were lost on July 9th, two on July 11th, four on July 12th, three on July 13th, one on July 18th, and one on 20th. The records are otherwise complete. No error has been detected at Kew.

Forty remeasurements have been made with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·4 | 0·3 |
| (2.) Mean difference irrespective of sign - - | 0·13 | 0·15 |
| (3.) Residual difference (Glasgow—Kew) - - | +0·05 | −0·04 |

The mean monthly difference between simultaneous standard and tabulated readings was—

| Dry. | Wet. |
|---|---|
| 0·13 | 0·14 |

*Kew.*—The Kew thermograph has been in good action during the month of July, and the photography has been good. The records are quite complete for the dry bulb thermometer. Owing to the wet bulb being out of action the following records were lost: One on July 9th, nine on July 11th, and oue on July 22nd.

The following error has been detected and put right:

July 24, 2 p.m., dry bulb standard, 62·7 should be 73·0.

Forty remeasurements have been made with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·02 | 0·02 |
| (2.) Mean difference irrespective of sign - - | 0·05 | 0·07 |
| (3.) Residual difference ($Kew^1$—$Kew^2$) - - | −0·02 | −0·02 |

The mean monthly difference between simultaneous standard and tabulated readings was—

| Dry. | Wet. |
|---|---|
| 0·11 | 0·13 |

*Stonyhurst.*—The thermograph has been in good action during the month of July, and the photography generally good, one or two curves being defective. On account of faintness of the curve the following records of the dry bulb have been lost, two on July 1st, and eight on July 11th. On account of the clock being out of repair seven hourly records for both bulbs were lost on July 3rd, and one hourly record of both bulbs was lost on July 16th, whilst the wet bulb was being covered with new muslin.

The following error has been detected and rectified:

Minimum on 22nd, which was 56·7 at midnight, should be 55·5 at 4 a.m.

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign - - | 0·13 | 0·11 |
| (3.) Residual difference (Stonyhurst—Kew) - - | −0·09 | +0·03 |

The mean monthly difference between standard and tabulated readings was—

| Dry. | Wet. |
|---|---|
| 0·12 | 0·15 |

*Valencia.*—The thermograph at Valencia has been in good action during the month of July, and the photography is good. The records for both bulbs are quite complete.

The following errors have been detected and put right:

In entry of standard reading—

July 5, 4 p.m., wet bulb 56·1 should be 60·1
„ 6, 4 p.m., wet bulb 60·0 „ 60·6

In tabulation—

Dry bulb retabulated from July 6, 11 a.m., to July 8, 10 a.m., the first tabulation having been made from a wrong setting of the scale.

Dry bulb curve from July 28, 11 a.m., to July 30, 10 a.m., the first measurements having been made from a standard reading, probably 1° wrong.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·03 | 0·04 |
| (2.) Mean difference irrespective of sign - - | 0·09 | 0·10 |
| (3.) Residual difference (Valencia—Kew) - - | 0·00 | −0·05 |

The mean monthly difference between simultaneous barograph and standard readings is—

| Dry. | Wet. |
|---|---|
| 0·13 | 0·18 |

In the following Table the number of hourly records lost during the month of July 1869 is exhibited.

| — | Anemograph. | | Barograph. | Thermograph. | | |
|---|---|---|---|---|---|---|
| | | | | Dry. | Wet Bulb. | |
| | Direction. | Velocity. | | | Not in action. | Other causes. |
| Aberdeen - - - - | 1 | 1 | 5 | 0 | 2 | 6 |
| Armagh - - - - | 17 | 19 | 16 | 16 | 0 | 33 |
| Falmouth - - - - | 0 | 0 | 1 | 3 | 0 | 3 |
| Glasgow - - - - | 5 | 5 | 0 | 0 | 13 | 0 |
| Kew - - - - | 0 | 0 | 0 | 0 | 11 | 0 |
| Stonyhurst - - - | 1 | 1 | 0 | 18 | 0 | 8 |
| Valencia - - - - | 0 | 0 | 0 | 0 | 0 | 0 |

## AUGUST.

### Anemograph.

*Aberdeen.*—The action of the direction pencil still remains somewhat unsatisfactory, and in a few instances the velocity trace shows the same peculiarities as in last month. The orientation was tested on August 2nd, and found correct. The records are quite complete.

The following errors in direction have been detected at Kew, and put right.

August 25th, 5 a.m., 17 should be 20
„ 28th, noon, 2 „ 0

Forty remeasurements of direction and velocity have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference - - - | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign - | 0·4 | 0·6 |
| (3.) Residual difference (Aberdeen—Kew) - | +0·2 | 0·0 |

*Armagh.*—The anemograph has been in good action during the month of August, and the records are quite complete. No errors in tabulation have been discovered at Kew.

Forty remeasurements of direction and velocity have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 1·0 |
| (2.) Mean difference irrespective of sign | 0·4 | 0·4 |
| (3.) Residual correction (Armagh—Kew) | +0·4 | 0·0 |

*Falmouth*—The anemograph at this station has been in good action during the month of August, and there are no blanks.

The orientation was tested on August 1st and found correct.

The following error in velocity was detected at Kew and put right:

August 21, 11 p.m., 21 should be 11.

Forty remeasurements of direction and velocity have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign | 0·3 | 0·6 |
| (3.) Residual difference (Falmouth—Kew) | —0·1 | —0·1 |

*Glasgow.*—During the greater part of August the direction trace exhibits the same faults as in last month. The velocity pencil has worked well with one exception. The clock having run down at 6.5 a.m. on the 18th of August, three hourly records of direction and four of velocity have been lost. No error in tabulation has been discovered at Kew.

Forty remeasurements of direction and velocity have been made at Kew.

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign | 0·3 | 0·4 |
| (3.) Residual difference (Glasgow—Kew) | —0·1 | —0·2 |

*Kew.*—The anemograph at this station has been in good action during this month. There are no blanks, and no error has been discovered. The orientation was tested on August 18th, and found correct.

Forty remeasurements have been made of direction and velocity, with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 1·0 |
| (2.) Mean difference, irrespective of sign | 0·1 | 0·4 |
| (3.) Residual difference ($Kew^1 - Kew^2$) | 0·0 | —0·2 |

*Stonyhurst.*—The anemograph at this station has been in good action during the month. The records are quite complete.

The following error has been detected in velocity, and put right:

Aug. 16, 7 p.m., 19 should be 9.

Also one or two small errors were found on the 19th, 22nd, and 25th, and corrected.

The orientation was tested on August 23rd, and found correct.

Forty remeasurements have been made at Kew, with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 2·0 |
| (2.) Mean difference, irrespective of sign | 0·2 | 0·6 |
| (3.) Residual difference (Stonyhurst—Kew) | 0·0 | —0·4 |

*Valencia.*—The anemograph at this station has been in good action during this month. There are, however, several small failures in the direction trace, and on the 30th two hourly records of direction were lost, and also five on the 31st, from the same cause. Ten hourly records of both direction and velocity were lost on August 6th, the clock having stopped; otherwise the records are complete.

Several small errors in velocity have been detected and corrected, and at 9 p.m. on the 16th 14 should be 2.

Forty remeasurements of direction and velocity have been made at Kew, with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 2·0 |
| (2.) Mean difference, irrespective of sign | 0·1 | 0·3 |
| (3.) Mean difference (Valencia—Kew) | —0·1 | —0·2 |

## Barograph.

*Aberdeen.*—The action of the barograph was good during August, but there were many failures, both from want of gas and bad photography.

On August 23rd nine hourly records lost; on the 25th one hour; on the 27th five hours; on the 28th 20 hours; on the 29th, 15; 30th, 9: in all, 59 hourly records have been lost. The following, being too indistinct for tabulation with the ordinary tabulating instrument, were measured at Kew to the nearest hundredth:—

| | |
|---|---|
| August 13 | 14 hours. |
| „ 14 | 4 „ |
| „ 25 | 14 „ |
| „ 26 | 24 „ |
| „ 27 | 18 „ |
| „ 29 | 7 „ |
| „ 31 | 3 „ |

The following errors have been detected and corrected:

In calculating residual correction—

| | | | |
|---|---|---|---|
| Aug. | 17–18 | −·006 should be | −·007 |
| „ | 18–19 | −·004 „ | +·002 |
| „ | 21–23 | +·002 „ | +·001 |
| „ | 30–31 | ·000 „ | −·001 |

Forty remeasurements have been made at Kew, with the following results:

| | |
|---|---|
| (1.) Greatest difference - - - - - | 0·0060 |
| (2.) Mean difference, irrespective of sign - - - | 0·0019 |
| (3.) Residual difference (Aberdeen—Kew) - - - | −0·0007 |

The mean monthly difference between simultaneous standard and barograph readings is 0·0020.

*Armagh.*—The barograph at this station has been in good action during the month, and the photography has been good. Bagging still exists to a slight extent.

Aug. 3rd, 1 p.m., the hourly record was lost, in consequence of the clock stopping.

The following errors have been detected and corrected at Kew:

In tabulation—

Aug. 28, 10 p.m., 29·576 should be 29·526

In calculating residual correction—

| | | | |
|---|---|---|---|
| Aug. | 23–24, | +·002 should be | +·001 |
| „ | 24–25, | +·003 „ | +·001 |
| „ | 31, | +·027 „ | +·026 |

In applying residual correction—

Aug. 25, 30·006 should be 30·004.

Forty measurements have been made at Kew, with the following results:

| | |
|---|---|
| (1.) Greatest difference - - - - - | 0·0060 |
| (2.) Mean difference, irrespective of sign - - - | 0·0020 |
| (3.) Residual correction (Armagh — Kew) - - - | −0·0002 |

The mean monthly difference between simultaneous standard and barograph readings is 0·0027.

*Falmouth.*—The barograph has been in good action during this month, but the photography has been indifferent on several occasions. Owing to this cause, nine hourly values were lost on Aug. 27.

The following, from the same cause, being too indistinct for tabulation with the ordinary tabulating instrument, were measured at Kew to the nearest hundredth:

August 27, 3 hours.
„ 28, 24 „
„ 29, 10 „

One hourly record was also lost on the 16th during alteration in gas pipes.

In all 10 hourly values have been lost.

Standard readings where omitted to be entered on the 16th at 2 p.m., on the 27th, noon, 4 p.m. and 10 p.m., on the 28th, 8 and 10 a.m., noon, 4 and 10 p.m., and on the 29th, 10 a.m.

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference - - - - - - | 0·0060 |
| (2.) Mean difference irrespective of sign - - - | 0·0021 |
| (3.) Residual difference (Falmouth—Kew) - - - | −0·0002 |

The mean monthly difference between simultaneous standard and barograph readings is 0·0020.

*Glasgow.*—The action of the Glasgow barograph was good during August, as was also the photography. The light-stop failed to act several times. The record for 11 a.m. on the 17th is lost, the instrument not having been stopped at the right time, otherwise there are no blanks.

The following errors have been detected and corrected at Kew:

In calculating residual correction—

| | | | |
|---|---|---|---|
| August | 15–16, | +·005 should be | +·006 |
| „ | 23–24, | +·007 „ | +·008 |
| „ | 24–25, | +·005 „ | +·004 |

In applying residual correction—

August 4, 6 p.m., 29·529 should be 29·527.

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference - - - - - - | 0·0050 |
| (2.) Mean difference irrespective of sign - - - | 0·0019 |
| (3.) Residual difference (Glasgow—Kew) - - - | +0·0009 |

The mean monthly difference between simultaneous standard and barograph readings is 0·0018.

*Kew.*—The barograph at this station has been in good action during the month and the photography has also been good. For the first half of the month the gas failed in several cases, the removal of a stoppage in the mains on the 16th did away with this source of inconvenience.

The following are the records lost through the above cause:

| | |
|---|---|
| August 3, 2 hours | August 12, 1 hour |
| „ 4, 1 „ | „ 14, 3 „ |
| „ 5, 1 „ | „ 16, 1 „ |
| „ 10, 2 „ | „ 17, 1 „ |
| „ 11, 1 „ | |

In all 13 hourly records have been lost.

The following errors have been detected and put right:

In entry of standard readings—

August 13, 4 p.m., 29·741 should be 29·841.

In applying residual correction—

| | | | |
|---|---|---|---|
| August 2, | 9 a.m., 29·973 | should be | 29·971 |
| „ 13, | 8 p.m., 29·812 | „ | 29·912 |
| „ 14, | 10 p.m., 30·225 | „ | 30·235 |
| „ 28, | 4 a.m., 30·282 | „ | 30·182 |
| „ | 5 a.m., 30·280 | „ | 30·180 |

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference - - - - - - | 0·0050 |
| (2.) Mean difference irrespective of sign - - - | 0·0016 |
| (3.) Residual difference (Kew$^1$—Kew$^2$) - - - - | +0·0007 |

The mean monthly difference between simultaneous standard and barograph readings is ·0018.

*Stonyhurst.*—The barograph at this station has been in good action during the month. On two occasions the photography was bad. From this cause 10 hourly values on August 3rd were lost, 19 on the 4th, eight on the 5th, and two on the 15th August. On August 19th clock stopped for two hours. In all 41 hourly records have been lost.

The following being too indistinct for tabulation with the ordinary tabulating instrument were measured at Kew to the nearest hundredth:

August 15, 10 hours
„ 16, 24 „
„ 17, 9 „

The following errors have been detected at Kew and put right:

In entry of standard readings—

August 15, 8 am., 29·831 should be 29·931.

In applying residual correction—

August 31, 3 p.m., 29·980 should be 29·990.

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference - - - - | 0·0050 |
| (2.) Mean difference irrespective of sign - - | 0·0014 |
| (3.) Residual difference (Stonyhurst—Kew) - | −0·0012 |

The mean monthly difference between simultaneous standard and barograph readings is ·0023.

*Valencia.*—The barograph at this station has been in good action during the month, and the photography has also been good.

The records are quite complete.

The following errors have been detected at Kew and put right:

In entry of standard readings—

August 28, 10 p.m., 30·147 should be 30·047

In calculating residual correction—

| | | | |
|---|---|---|---|
| August | 8– 9, −·019 | should be | −·030 |
| „ | 9–10, −·021 | „ | −·017 |
| „ | 23–24, −·025 | „ | −·026 |

In applying residual correction—

| | | | |
|---|---|---|---|
| August | 2, noon, 29·984 | should be | 29·974 |
| „ | 6, 1 a.m., 30·383 | „ | 30·393 |
| „ | 13, 8 a.m., 29·927 | „ | 30·027 |
| „ | 15, 9 p.m., 30·233 | „ | 30·333 |
| „ | 18, 1 p.m., 30·390 | „ | 30·396 |

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference - - - - | 0·0050 |
| (2.) Mean difference irrespective of sign - - | 0·0018 |
| (3.) Residual difference - - - - | +0·0002 |

The mean monthly difference between simultaneous standard and barograph readings is ·0021.

## Thermograph.

*Aberdeen.*—The Aberdeen thermograph has been in good action during August, but the photography has been somewhat indifferent.

Owing to a photographic blemish one hourly record both for dry and wet bulbs was lost on August 7th, otherwise the records are quite complete.

The following errors have been detected at Kew and rectified:

August 26th, 8 p.m., dry bulb standard reading entered at 7 p.m.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | We. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign - - | 0·14 | 0·15 |
| (3.) Residual difference (Aberdeen—Kew) - - | +0·07 | +0·06 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·17 | 0·17 |

*Armagh.*—The thermograph has been in good action during the month, and the photography has been good. In consequence of the misadjustments of the lights on the 25th August, two hourly records of the wet bulb are lost, and 11 on the following day.

Three hourly records of the dry bulb were lost on the 26th from the same cause, as were also three hourly records of the wet bulb on the 29th.

The following errors have been detected and put right:

In entry of standard reading—

August 25th, 10 a.m., wet bulb, 63·3 should be 63·5

Errors of tabulation—

| | | | | | |
|---|---|---|---|---|---|
| August | 2d, | 11 a.m., | dry bulb, 57·0, | should be | 58·0 |
| „ | 3rd, | 8 a.m., | „ 51·0 | „ | 50·4 |
| „ | 3rd, | 9 a.m., | „ 51·8 | „ | 51·0 |
| „ | 6th, | 7 a.m., | „ 50·4 | „ | 49·3 |
| „ | 6th, | 11 a.m., | wet bulb, 54·0 | „ | 53·2 |
| „ | 6th, | 3 p.m., | „ 56·9 | „ | 54·1 |
| „ | 8th, | 9 a.m., | dry bulb, 58·7 | „ | 59·7 |
| „ | 10th, | 11 a.m., | „ 55·0 | „ | 56·0 |
| „ | 10th, | 1 p.m., | „ 53·5 | „ | 54·5 |
| „ | 10th, | 2 p.m., | „ 53·1 | „ | 55·1 |
| „ | 11th, | 5 a.m., | „ 50·6 | „ | 50·0 |
| „ | 11th, | 4 p.m., | „ 59·4 | „ | 57·6 |
| „ | 12th, | 11 p.m., | wet bulb, 56·0 | „ | 60·0 |
| „ | 16th, | 9 a.m., | dry bulb, 55·9 | „ | 59·1 |
| „ | 17th, | 2 a.m., | „ 52·9 | „ | 53·7 |

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·4 | 0·4 |
| (2.) Mean difference irrespective of sign - - | 0·21 | 0·19 |
| (3.) Residual difference (Armagh—Kew) - - | + 0·03 | —0·04 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·14 | 0·19 |

*Falmouth.*—The thermograph has been in good action during the month, but the photography has been somewhat indifferent.

Four hourly records of the dry bulb and three of the wet have been lost in consequence of photographic defects on August 27th, and at various times during the month.

Seven hourly records of the dry bulb and six of the wet bulb have been lost through failure of gas. Owing to the wet bulb being out of action, the following records were lost: three on the 5th, eight on the 26th, thirteen on the 30th, and ten on 31st.

The light-stop failed to act from midnight on the 24th to 11 a.m. on the 31st.

No error in tabulation has been detected at Kew.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | - 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign - - | - 0·13 | 0·16 |
| (3.) Residual difference (Falmouth—Kew) - - | + 0·03 | + 0·02 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·09 | 0·11 |

*Glasgow.*—The thermograph has been in good action during the month, and the photography has been good. The records of the dry bulb are quite complete. Owing to the wet bulb being out of action the following records have been lost: one on the 10th, one on the 11th, two on the 21st, and two on the 29th.

The following errors have been detected at Kew and put right:

In tabulation—

August 15th, 11 p.m., dry bulb, 57·1 should be 56·7

Midnight „ 56·4 „ 55·0

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | - 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign - - | - 0·11 | 0·13 |
| (3.) Residual difference (Glasgow—Kew) - - | —0·2 | —0·2 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·13 | 0·13 |

*Kew.*—The action of the thermograph at this station and the photography has been good during the month. The records of the dry bulb are complete. Owing to the wet bulb being out of action, the following records have been lost: one on the 2d, one on the 5th, three on the 6th, one on the 6th, two on the 12th, and one on the 30th.

The following error in tabulation has been detected and put right:

August 22d, 10 p.m., dry bulb 58·3, should be 59·3

Forty remeasurements have been made with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·2 | 0·2 |
| (2.) Mean difference irrespective of sign - - | 0·09 | 0·11 |
| (3.) Residual difference (Kew$^1$—Kew$^2$) - - | —0·06 | —0·05 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·13 | 0·08 |

*Stonyhurst.*—The action of the thermograph at this station and the photography have been good during the month. The dry bulb records are quite complete. On account of faintness of trace, seven hourly records of wet bulb were lost August 31st.

The following error has been detected at Kew and put right:

In tabulation—

August 10th, 11 a.m., wet bulb, 47·6 should be 48·2

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign - - | 0·15 | 0·16 |
| (3.) Residual difference (Stonyhurst—Kew) - - | —0·05 | — 0·03 |

The mean monthly difference between simultaneous standard and tabulation reading is—

| Dry. | Wet. |
|---|---|
| ·12 | ·14 |

*Valencia.*—The thermograph has been in good action during the month, the photography has also been good. The records are quite complete. Owing to a mis-setting of the scale, it was found necessary to retabulate at Kew the wet bulb from 11 a.m. on the 11th to 10 a.m. on the 13th. No other errors have been discovered.

Forty remeasurements have been made a Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign - - | 0·11 | 0·09 |
| (3.) Residual difference (Valencia—Kew) - - | 0·00 | + 0·01 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·17 | 0·15 |

In the following table the number of hourly records lost during the month of August 1869 is exhibited:

| | Anemograph. | | Barograph. | Thermograph. | | |
|---|---|---|---|---|---|---|
| | | | | | Wet Bulb. | |
| | Direction. | Velocity. | | Dry. | Not in action. | Other causes. |
| Aberdeen - - - - | 0 | 0 | 59 | 1 | 0 | 1 |
| Armagh - - - - | 0 | 0 | 1 | 3 | 0 | 16 |
| Falmouth - - - - | 0 | 0 | 10 | 11 | 34 | 9 |
| Glasgow - - - - | 3 | 4 | 1 | 0 | 6 | 0 |
| Kew - - - - | 0 | 0 | 13 | 0 | 9 | 0 |
| Stonyhurst - - - | 0 | 0 | 41 | 0 | 0 | 7 |
| Valencia - - - - | 17 | 10 | 0 | 0 | 0 | 0 |

Mr. Scott reported that the anemograph had been erected at Holyhead, and had been in action since August 20.

Also, that the anemograph and the barograph (Milne's pattern) had been erected at Great Yarmouth, and had been in action since September 17.

Read—A letter from Rev. C. Clouston, Sandwick Manse, requesting an allowance of 20*l.* for the current year instead of 10*l.*, in order to defray the expenditure of erection of the new anemograph, which was set in action on June 22.—Granted.

Read—The following report to the Director :—

SIR,

WITH this I beg to hand you the result of various trials of deep-sea thermometers under pressure.

On receiving notice from Mr. Casella that he had several thermometers ready, and asking for some one to be sent from this office to witness their being tested, I thought the matter of sufficient importance to go myself, accompanied by Mr. Strachan, who carefully read the instruments and afterwards drew up the accompanying memorandum of the results.

Knowing that there were observations lying in this office which had been made by certain protected thermometers devised by the late Admiral FitzRoy, I thought that their value would be enhanced if we subjected one of his instruments to the same test. This was done; and it is satisfactory to know that at a pressure of one ton per square inch the displacement of the index, when observed under pressure, only amounted to two-tenths of a degree, whilst at a pressure of 2½ tons per square inch it only amounted to 1°·5.

The memorandum shows that the greatest variation of the instruments protected on Dr. Miller's principle only amounted to 1°·1, whilst the error of an unprotected one amounted to 10°·5.

I remain, &c.

HENRY TOYNBEE,
Marine Superintendent.

MEMO.

TRIALS of DEEP-SEA THERMOMETERS under HYDRAULIC PRESSURE, at Mr. Casella's, 23, Hatton Garden, 28th September 1869.

First trial; pressure 2½ tons per square inch.

| Provisional Number of Thermometer. | | Temperature of Water. | | | Readings of Indices after Pressure. | |
|---|---|---|---|---|---|---|
| | | Before Pressure. | | After Pressure. | | |
| | | By Min. Index. | By Max. Index. | By Mercury Column. | Min. | Max. |
| Standard* | - | - - - | 60·5 | Not recorded. | - - - | 61·1 |
| Protected by spirit jacket. | 1 | 60·5 | 60·5 | | 60·5 | 62·0 |
| | 2 | 60·3 | 60·4 | | 60·1 | 61·8 |
| | 3 | 60·3 | 60·3 | | 60·2 | 62·0 |
| | 4 | 60·2 | 60·3 | | 60·1 | 61·4 |
| | 5 | 60·2 | 60·5 | | 60·2 | 61·8 |
| | 6 | 60·2 | 60·3 | | 60·1 | 61·5 |

Result: The minimum indices in no case affected by pressure; the standard rose 0°·6, and the maximum indices rose on an average 1°·37.

Second trial; pressure 2½ tons:

| | | | | | | |
|---|---|---|---|---|---|---|
| Standard | - | - - - | 61·0 | 61·0 | - - - | 61·3 |
| Protected by spirit jacket. | 7 | 60·8 | 60·8 | 60·9 | 60·5 | 62·0 |
| | 8 | 60·7 | 60·8 | 60·8 | 60·5 | 62·0 |
| | 9 | 60·5 | 60·5 | 60·5 | 60·3 | 61·5 |
| | 10 | 60·4 | 60·8 | 60·6 | 60·5 | 62·0 |
| | 11 | 60·8 | 61·0 | 60·8 | 60·8 | 61·8 |
| | 12 | 60·7 | 60·8 | 60·6 | 60·5 | 62·0 |

Result: Little or no effect upon minimum indices, standard rose 0·3, maximum indices rose 1°·10.

Third trial; pressure 2½ tons.

| | | | | | | |
|---|---|---|---|---|---|---|
| Standard | - | - - - | 61·2 | - - - | - - - | 61·4 |
| Pastorelli 73 | - | 61·0 | 60·8 | 61·0 | 61·0 | 71·5 |

Result: This thermometer was an ordinary six's, without protection; the minimum was not moved; the maximum rose 10°·7; the standard rose 0°·2.

Fourth trial; pressure 1 ton.

| | | | | | | |
|---|---|---|---|---|---|---|
| Standard | - | - - - | 61·2 | - - - | - - - | 61·5 |
| Negretti 19 | - | 61·0 | 61·0 | 61·3 | 61·0 | 61·5 |

* The instrument used throughout these experiments as the "Standard" was a mercurial maximum thermometer, No. 9,645, on Professor Phillips' plan, the index consisting of a small detached cylinder of mercury, this thermometer being enclosed in a strong outer tube containing a little spirits of wine hermetically sealed.

Fifth trial ; pressure 2 tons.

| Provisional Number of Thermometer. | Temperature of Water. | | | Readings of Indices after Pressure. | |
|---|---|---|---|---|---|
| | Before Pressure. | | After Pressure. | | |
| | By Min. Index. | By Max. Index. | By Mercury Column. | Min. | Max. |
| Standard - | - - - | 61·2 | 61·3 | - - - | 61·6 |
| Negretti 19 - | 61·0 | 61·0 | 61·3 | 61·3 | 62·6 |

Sixth trial ; pressure $2\frac{1}{2}$ tons.

| | | | | | |
|---|---|---|---|---|---|
| Standard - | - - - | 61·5 | 61·5 | - - - | 61·8 |
| Negretti 19 - | 61·2 | 61·2 | 61·6 | 61·0 | 63·0 |

The thermometer 19 was protected with jacket of mercury, and was one made for Admiral FitzRoy. One ton had no sensible effect on this instrument; two tons raised the maximum index 1°·6; and $2\frac{1}{2}$ tons raised it 1°·8. It is noticeable that the standard rose the same amount 0·3 under all pressures. This may be due to heat developed by friction or compression. Regarding it as such, the following resumé shows the effect of compression or pressure *per se*.

| —— | Thermometer Rise due to | | | Tons per inch. |
|---|---|---|---|---|
| | Heat and Pressure. | Heat. | Pressure. | |
| Standard - - - | 0·6 | 0·6 | 0·0 | $2\frac{1}{2}$ |
| 1 - - - | 1·5 | „ | 0·9 | „ |
| 2 - - - | 1·4 | „ | 0·8 | „ |
| 3 - - - | 1·7 | „ | 1·1 | „ |
| 4 - - - | 1·1 | „ | 0·5 | „ |
| 5 - - - | 1·3 | „ | 0·7 | „ |
| 6 - - - | 1·2 | „ | 0·6 | „ |
| Standard - - | 0·3 | 0·3 | 0·0 | „ |
| 7 - - | 1·2 | „ | 0·9 | „ |
| 8 - - | 1·2 | „ | 0·9 | „ |
| 9 - - - | 1·0 | „ | 0·7 | „ |
| 10 - - - | 1·2 | „ | 0·9 | „ |
| 11 - - - | 0·8 | „ | 0·5 | „ |
| 12 - - - | 1·2 | „ | 0·9 | „ |
| Standard - - - | 0·2 | 0·2 | 0·0 | „ |
| 73 - - - | 10·7 | „ | 10·5 | „ |
| Standard - - - | 0·3 | 0·3 | 0·0 | 1 |
| 19 - - - | 0·5 | „ | 0·2 | „ |
| Standard - - - | 0·3 | 0·3 | 0·0 | 2 |
| 19 - - - | 1·6 | „ | 1·3 | „ |
| Standard - - - | 0·3 | 0·3 | 0·0 | $2\frac{1}{2}$ |
| 19 - - - | 1·8 | „ | 1·5 | „ |

Read—A letter from Captain Toynbee recommending Mr. S. W. Hodding, second officer Peninsular and Oriental Company's barque, "Indus;" Mr. Greenwood, second officer Cunard Company's steamer "Scotia;" Captain F. Wherland, ship "Galatea;" Captain C. T. Raymond, ship "British India," for copies of the Admiralty pilot charts, in consideration of the excellency of their registers.

Resolved—That the same be presented, and that Mr. Scott be instructed to convey to the respective officers the marked thanks of this Committee for their valuable assistance.

Read—A letter from S. R. Graves, Esq., M.P., for Liverpool, recommending that some public notice should be taken of high class observations.

Resolved—That the names of all gentlemen to whom the pilot charts have been presented be printed in the annual report.

Mr. Scott reported that copies of the Daily Weather Report had been issued, free of cost, to—

M. C. St. Claire Deville, President of the Meteorological Commission, Paris.

Blackpool Pier Company,
Porthcawl Harbour Master,
Ventnor, J. G. Livesay, Esq., } for exhibition at the ports.

And that Messrs. H. Lee and Sons, Contractors for the Zuyder Zee Drainage, had applied for, and obtained it, at the annual cost of 2*l.* 10*s.*—Approved.

He also stated that inquiries had been made at the various ports, and that the telegrams were now posted up at most of the drum signal stations.

Read—Applications for the loan of fishery barometers, from Bognor and Kinsale.

The application was complied with in each case.

The sale of a fishery barometer to Mr. Balbirnie, for the Dockmaster's Office, Leith, was confirmed.

Mr. Galton submitted a model of a portion of a pantagraph, invented by himself, with the following explanation of its principle :—

## ON THE PRINCIPLE OF THE PANTAGRAPH DESIGNED BY F. GALTON.

In the pantagraph I designed in the early part of this year to reduce the tracings of the various self-recording meteorological instruments, the reduction was effected by two separate but similar actions in length and in breadth. One hand of the operator controlled the movements from side to side of the original tracing, and of the plate that was to receive the reduced figure; the other hand controlled the movements up and down of the style that was to pass over the original figure, and of the point that was to scratch the reduced copy. In both cases the reduction was effected by means of an arm connected through links, with carriages running on a tramway. The following analysis shows the conditions of length and position that have to be observed in making and adjusting the instrument, the construction of which, in a substantial form, is now contemplated.

I do not propose to enter into mechanical details in this short description, but merely to explain the fundamental principles of the arrangement. I may, however, mention that the introduction of a reducing wheel into the movement would enable us to reduce a large drawing into a small space with a comparatively short arm, and might prove important in the reduction *in breadth* of the tracings with which the Meteorological Office has to deal.

C A B is an arm which can be moved round C to any desired position as C $A_1$ $B_1$ or C $A_2$ $B_2$.

*a* is a point on a carriage that moves along a tramway, or is otherwise guided, so that it may be pushed to any desired position in the line X X, but nowhere else. It is connected with C A B by a link A*a*, and therefore assumes the positions $a_1$ $a_2$, corresponding to the positions of the arm C $A_1$ $B_1$, C $A_2$ $B_2$.

Similar arrangements are made in respect to B, and the two tramways are made parallel to one another.

Required to find the conditions, if any, that will cause the movements of *a* and *b* to bear a uniform proportion to one another.

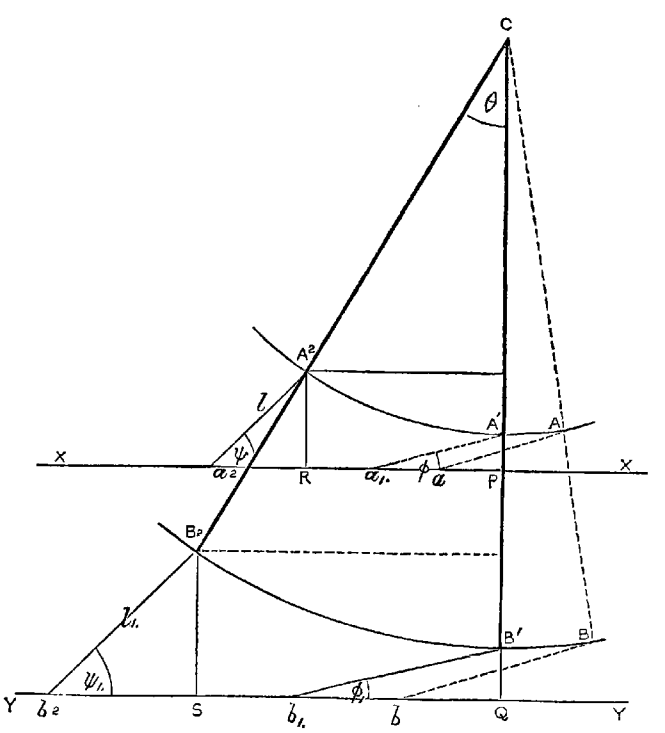
Take C $A_1$ $B_1$ perpendicular to the tramways, and let C $A_2$ $B_2$ be any other portion of the arm. Let fall the perpendiculars $A_2$ R, $B_2$ S.

Call the vertical angle, $\theta$; call the angle $A_2$ $a_2$ P, $\psi$; the angle $A_1$ $a_1$ P, $\varphi$; and the link A*a*, *l*.

Let the corresponding values in the arrangement connected with B be $\psi_1$, $\varphi_1$, and $l_1$.

Now $\psi$ is known in terms of the rest, because

(1) $l \sin \psi = \text{C A versin } \theta + l \sin \varphi$, and so for $\psi_1$,




therefore our problem is to find the relations (if they exist) between $\varphi$ and $\varphi_1$; *l* and $l_1$; C A and C B; that shall ensure the space of $a_1$ $a_2$ to bear a constant relation to $b_1$ $b_2$, = say $\frac{1}{c}$, for all values of $\theta$.

$$a_1 a_2 = \text{P}a_2 - \text{P}a_1 = \text{R}a_2 + \text{R P} - \text{P}a_1$$
$$b_1 b_2 = \text{Q}b_2 - \text{Q}b_1 = \text{S}b_2 + \text{S Q} - \text{Q}b_1$$
$$\frac{a_1 a_2}{b_1 b_2} = \frac{l \cos \psi + \text{C A} \sin \theta - l \cos \varphi}{l_1 \cos \psi_1 + \text{C B} \sin \theta - l_1 \cos \varphi} = \frac{1}{c}$$

but from (1) $l \cos \psi = l\sqrt{1 - \sin^2 \psi} = \sqrt{l^2 - (l \sin \varphi + \text{C A vers. } \theta)^2}$

and similarly for $l_1 \cos \psi_1$

therefore $$\frac{\sqrt{l^2 - (l \sin \varphi + \text{C A versin } \theta)^2} + \text{C A} \sin \theta - l \cos \varphi}{\sqrt{l_1^2 - (l_1 \sin \varphi_1 + \text{C B versin } \theta)^2} + \text{C B} \sin \theta - l_1 \cos \varphi_1} = \frac{1}{c}.$$

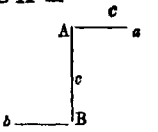
*First*, we see that these values can be real only so long as $l \sin \varphi$ + C A versin $\theta$ (or A, R) is less than *l*; or the distance between A and the tramway is less than the length of the link, a fact which is evident enough on inspection of the figure.

*Secondly*, the equation holds for the combined values $\varphi = \varphi_1$, $\frac{l}{l_1} = \frac{1}{c}$, $\frac{\text{C A}}{\text{C B}} = \frac{1}{c}$, and for no other ones.

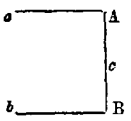
We may simplify the conditions yet further, by making $\varphi = \varphi_1 = o$; that is to say, by so arranging the instrument that the link shall be parallel to the tramway when C A B is perpendicular to it; in this case the adjustment of $\frac{C A}{C B} = \frac{1}{c}$ must be made by varying the position of C, while those of A and of B remain intact.

If it be desired that $\frac{1}{c}$ should be negative, or $\frac{l}{l_1} = -\frac{1}{c}$, and $\frac{C A}{C B} = -\frac{1}{c}$, *i.e.*, that the movements of the arms should be in contrary directions, or that the reduction should be reversed, then $l = \frac{-l_1}{c}$ and $C A = \frac{-C B}{c}$

or both $l_1$ and C B will have opposite signs to $l$ and C A, and therefore the arms will lie thus




and not thus




*First adjustment*:—To find the position of C so that $\frac{C A}{C B}$ shall $= \frac{1}{c}$.

(1) When A lies between C and B

$$\frac{C A}{C B} = \frac{C A}{C A + A B} = \frac{1}{c}, \text{ or } C A (c-1) = A B, \; C A = \frac{A B}{c-1}$$

(2) When C lies between A and B (reverse action)

$$\frac{C A}{C B} = \frac{C A}{A B - A C} = \frac{1}{c}, \text{ or } C A = \frac{A B}{c+1}.$$

Hence A B ought to be divided into some convenient number of graduations, and one that is divisible in many ways, such as 60; and the graduations should be numbered from A towards B. The same scale of divisions should be continued on the other side of A, and those graduations should be separately numbered, beginning also from A. It is then easy to find the position of $c$. For example, if it be required to reduce to $\frac{1}{4}$, $c = \frac{1}{4}$.

(1) Direct reduction: Set C among the upper graduations at

$$\frac{60}{4-1}, \text{ or at } 20; \text{ then } C A = 20 \quad C B = C A + A B = 80, \text{ and } \frac{C A}{C B} = \frac{20}{4 \times 20}.$$

(2) Reverse reduction: Set C among the lower graduations at

$$\frac{60}{4+1} \text{ or at } 15; \text{ then } C A = 15 \quad C B = 60, \text{ and } \frac{C A}{C B} = \frac{15}{4 \times 15}.$$

*Second adjustment*:—To find the position of $a$ so that $\frac{A a}{B b}$ shall $= \frac{1}{c}$, it being, at the same time, required that C B and B $b$ shall remain intact.

Since, in the two triangles C A $a$, C B $b$, the sides C A, A $a$ are proportional to C B, B $b$, and since C A $a$, C B $b$ are right angles, as also the vertical angles at C are identical in case (1) and equal in case (2), it follows that the triangles are similar, and that C $a$ $b$ is a straight line. Consequently, after making the adjustment described in the last paragraph, of $\frac{C A}{C B} = \frac{1}{c}$, we have simply to shift $a$ into the line C $b$, and the adjustment is complete.

These adjustments of C and of $a$ are mechanically to be effected on the same principle that is employed in shifting the centre of the well-known instrument, the proportional compasses.

Read—A letter from Dr. Otto Kersten, requesting the loan of certain observations from the East Coast of Africa, to aid him in the preparation of a meteorological report, to accompany the account of the late Baron von der Decken's travels.

Resolved—That Mr. Scott be authorized to furnish the observations.

Read—A letter from M. Coumbary, of the Meteorological Observatory, Constantinople, agreeing to exchange publications regularly with this office.

Read—A letter from M. Mohn, proposing to remodel the entire system of weather telegraphy between this office and Norway, in consequence of the recent laying of a cable direct from Peterhead to the coast of Norway.

The consideration of this letter was referred to Mr. Scott for the present.

Mr. Scott reported that on the 3d of August an order for 6,000*l.*, being the balance of the Parliamentary Grant, had been received from Her Majesty's Treasury, and that he had lodged 5,000*l.* to the deposit account of the Committee at the London and Westminster Bank, and 1,000*l.* to their credit account in the Bank of England, as directed on the 19th July. He further reported that on the 4th of October he had, on the signature of Captain Richards, transferred 1,000*l.* from the above deposit account to the current account of the Committee.

The following quarterly statement was submitted:—

ACCOUNTS PAID, AND LIABILITIES, SEPTEMBER 30TH.

| | Paid. | Salaries and Accounts unpaid now presented. | Estimated Liabilities. |
|---|---|---|---|
| | £ s. d. | £ s. d. | £ s. d. |
| Salaries | 1,584 16 10 | — | — |
| Instruments, Mercantile Marine | 22 2 3 | - - - | 67 8 7 |
| „ Admiralty | 51 8 5 | - - - | 43 16 6 |
| Agencies at Ports | 31 7 0 | - - - | 5 12 8 |
| Travelling | 46 10 7 | 70 6 5 | — |
| Telegraphy | 1,067 5 11 | - - - | 172 15 0 |
| Observatories, Current Expenses | 1,063 7 10 | - - - | 33 0 9 |
| „ Outfit | 259 3 9 | - - - | 7 0 0 |
| Special Printing | 45 7 1 | - - - | 1 18 6 |
| Contingencies | 1,143 13 8 | - - - | 49 0 0 |
| Totals | 5,315 3 4 | 70 6 5 | 380 12 0 |

Grand total - 5,766*l.* 1*s.* 9*d.*

ROBERT H. SCOTT,
Director.

Mr. Scott reported that the following cheques were drawn July 26th on Sir E. Sabine's signature :—

| | £ s. d. |
|---|---|
| For Salaries for July : | |
| R. H. Scott | 66 13 4 |
| H. Toynbee | 33 6 8 |
| B. Stewart | 33 6 8 |
| W. Salmon | 18 6 8 |
| J. S. Harding, jun. | 14 3 4 |
| R. Strachan | *16 13 4 |
| S. Jeffery (4 weeks to 28th) | 12 0 0 |
| F. Gaster | 10 16 8 |
| C. Harding | 9 3 4 |
| R. H. Curtis | 7 10 0 |
| F. Steventon | 6 13 4 |
| J. S. Harding, sen. (4 weeks to 28th) | 7 14 0 |
| E. Magrath (4 weeks to 28th) | 5 0 0 |
| A. D. Spencer „ „ | 5 0 0 |
| J. Curtis „ „ | 5 0 0 |
| W. G. James „ „ | 5 0 0 |
| G. G. Francis „ „ | 3 0 0 |
| F. Brodie „ „ | 3 0 0 |
| For instruments : | |
| B. Stewart, verifications | 12 17 0 |
| For Admiralty Instruments : | |
| B. Stewart, verifications | 21 8 0 |
| For Travelling Expenses : | |
| R. H. Scott, on account | 50 0 0 |
| For Observatories : | |
| Thomas Kerr (Valencia) salary | 20 16 8 |
| Do. Expenses, June quarter | 37 7 8 |
| Thomas Culleton, stencil plates | 2 14 4 |
| For Special Printing, &c. : | |
| S. King, books, &c. | 3 15 1 |
| For Contingencies : | |
| J. Parsons, balance for fittings | 60 10 0 |
| For Office Petty Expenses : | |
| R. H. Scott (on account) | 25 0 0 |
| | £496 16 1 |

* Including allowance for care of instruments.

And that the following cheques were drawn, 25th August, on Mr. Spottiswoode's signature:—

| | £ | s. | d. |
|---|---|---|---|
| For Salaries for August:— | | | |
| R. H. Scott | 66 | 13 | 4 |
| H. Toynbee | 33 | 6 | 8 |
| B. Stewart | 33 | 6 | 8 |
| W. Salmon | 18 | 6 | 8 |
| J. S. Harding, jun. | 14 | 3 | 4 |
| R. Strachan | *16 | 13 | 4 |
| S. Jeffery (4 weeks to 25th) | 12 | 0 | 0 |
| F. Gaster | 10 | 16 | 8 |
| C. Harding | 9 | 3 | 4 |
| R. H. Curtis | 7 | 10 | 0 |
| F. Steventon | 6 | 13 | 4 |
| J. S. Harding, sen. (4 weeks to 25th) | 7 | 14 | 0 |
| E. Magrath " " | 5 | 0 | 0 |
| A. D. Spencer " " | 5 | 0 | 0 |
| J. Curtis " " | 5 | 0 | 0 |
| W. G. James " " | 5 | 0 | 0 |
| G. G. Francis " " | 3 | 0 | 0 |
| F. Brodie " " | 3 | 0 | 0 |
| For Agencies: | | | |
| H. J. Smart, Liverpool | 3 | 17 | 2 |
| For Telegraphy: | | | |
| Electric Company, account for June — £63 19 6 | | | |
| " special charges, April — 16 17 9 | | | |
| " " May — 16 0 0 | | | |
| " " June — 19 2 9 | | | |
| | 116 | 0 | 0 |
| Magnetic Company, account for June | 46 | 14 | 7 |
| Submarine Company, " | 30 | 10 | 11 |
| For Expenses at Observatories: | | | |
| T. Kerr, salary for August | 20 | 16 | 8 |
| For Contingencies, &c.: | | | |
| E. Stanford, newspapers, &c. | 2 | 7 | 1 |
| Davey, Thompson, and Alder, coals | 8 | 16 | 0 |
| For Office Petty Expenses: | | | |
| J. S. Harding, jun. (on account) | 30 | 0 | 0 |
| Total | £521 | 9 | 9 |

The following cheque was drawn on the 11th September, on Dr. Miller's signature:—

| | £ | s. | d. |
|---|---|---|---|
| J. S. Harding, jun., for office expenses, on account | 25 | 0 | 0 |

The following cheques had been drawn on the 30th September on Captain Richard's signature:—

| | £ | s. | d. |
|---|---|---|---|
| For Salaries for September: | | | |
| R. H. Scott | 66 | 13 | 4 |
| H. Toynbee | 33 | 6 | 8 |
| B. Stewart | 33 | 6 | 8 |
| W. Salmon | 18 | 6 | 8 |
| J. S. Harding, jun. | 14 | 3 | 4 |
| R. Strachan | *16 | 13 | 4 |
| S. Jeffery (5 weeks, to 29th) | 15 | 0 | 0 |
| F. Gaster | 10 | 16 | 8 |
| C. Harding | 9 | 3 | 4 |
| R. H. Curtis | 7 | 10 | 0 |
| F. Steventon | 6 | 13 | 4 |
| Carried forward | £231 | 13 | 4 |

* Including allowance for care of instruments.

| | £ | s. | d. |
|---|---|---|---|
| Brought forward | 231 | 13 | 4 |
| J. S. Harding, sen. (5 weeks to 29th) | 9 | 12 | 6 |
| E. Magrath „ „ | 6 | 5 | 0 |
| A. D. Spencer „ „ | 6 | 5 | 0 |
| J. Curtis „ „ | 6 | 5 | 0 |
| W. G. James „ „ | 6 | 5 | 0 |
| G. Francis „ „ | 3 | 15 | 0 |
| F. Brodie „ „ | 3 | 15 | 0 |
| For Telegraphy: | | | |
| Electric Telegraph Company, July 45 9 6 | | | |
| Ditto special charges „ 15 11 8 | | | |
| Ditto account for August 41 16 10 | | | |
| Ditto special charges „ 18 17 9 | | | |
| | 121 | 15 | 9 |
| Magnetic Telegraph Company, July 49 17 6 | | | |
| Ditto August 48 4 4 | | | |
| | 98 | 1 | 10 |
| Submarine Telegraph Company, July 33 17 4 | | | |
| Ditto August 31 13 2 | | | |
| | 65 | 10 | 6 |
| E. Higgs, frames for telegrams | 12 | 10 | 0 |
| For Observatories: | | | |
| B. Stewart, Kew— | | | |
| Allowance for quarter | 112 | 10 | 0 |
| Sundry accounts | *101 | 4 | 0 |
| D. Thomson, Aberdeen— | | | |
| Allowance for quarter 62 10 0 | | | |
| Sundry accounts 0 13 6 | | | |
| | 63 | 3 | 6 |
| T. R. Robinson, Armagh— | | | |
| Allowance for quarter | 33 | 15 | 0 |
| W. P. Dymond, Falmouth— | | | |
| Allowance for quarter | 66 | 5 | 0 |
| R. Grant, Glasgow— | | | |
| Allowance for quarter | 62 | 10 | 0 |
| S. J. Perry, Stonyhurst— | | | |
| Allowance for quarter | 50 | 0 | 0 |
| T. Kerr, Valencia— | | | |
| Salary for September | 20 | 16 | 8 |
| Expenses for quarter | 47 | 3 | 10 |
| R. & J. Beck, anemographs | 158 | 14 | 0 |
| Standidge & Co., forms for do. | 6 | 16 | 0 |
| For Special Printing, &c.: | | | |
| Davy & Sons, 6 months' account | 2 | 13 | 6 |
| Williams & Norgate, books, &c. | 3 | 14 | 0 |
| For Contingencies: | | | |
| C. W. Jacques, rent of office | 93 | 2 | 6 |
| J. Merren, office blinds | 4 | 4 | 4 |
| Office Petty Expenses: | | | |
| J. S. Harding, jun. (on account) | 25 | 0 | 0 |
| | £1,423 | 6 | 3 |

A cheque for 20*l.* 6*s.* 5*d.* was drawn in favour of Mr. Scott, for the balance of his travelling expenses.

* Including Expenses on account of Inspection of Observatories.

Read—The following letter from Dr. Balfour Stewart:—

DEAR SIR, Richmond, 8th October 1869.

I BEG to tender you my resignation of the office of Secretary to the Meteorological Committee of the Royal Society and Director of their Normal Observatory. I leave the time of my resignation open, wishing as much as possible to suit the convenience of the Committee.

I remain, &c.
(Signed) B. STEWART.

Lieut.-General Sir E. Sabine, K.C.B.,
Chairman of the Meteorological Committee
of the Royal Society.

The Committee then adjourned.

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116, *Victoria Street, Monday, October* 25, 1869.

PRESENT:

Sir E. Sabine in the Chair.

| | |
|---|---|
| Mr. De La Rue. | Dr. W. A. Miller. |
| Mr. Gassiot. | Captain Richards. |

The Director was in attendance.

The Minutes of the last meeting were read and confirmed.

The Director reported that, pursuant to the instructions given at last meeting, he had written to the authorities at the respective ports with reference to the Semaphores, but had as yet received no reply.

Submitted. A letter from Lloyd's, requesting that a copy of the Daily Weather Report be supplied to them every morning, and that copies of all warning messages issued be also sent to the rooms.

Mr. Scott stated that he had at once ordered the copy of the Weather Report to be supplied, and that the application for Storm Warnings would be forwarded to the Board of Trade in the usual way.—Approved.

Submitted. Applications for the loan of Fishery Barometers to Boscastle, Cornwall, and Ventnor, Isle of Wight.—Granted.

Submitted. An estimate for altering a Milne's Barograph so as to make it register hourly; expense 6*l*.—Sanctioned.

It was resolved, on Captain Toynbee's suggestion, that the Charts of Sea Surface Temperature might be issued to all captains observing for the office if they wished for them.

The Secretary presented the following report regarding the records for September 1869, received from the self-recording instruments of the various observatories, and which have been examined at Kew in accordance with the regulations adopted by the Meteorological Committee. (See Minutes, 21st December 1868.)

ANEMOGRAPH.

*Aberdeen.*—The anemograph at this station has been in good action during the month of September. On the 7th the cylinder was omitted to be clamped after the sheet had been changed, and in consequence 24 hourly records for both velocity and direction were lost; otherwise there are no blanks.

The following error was detected at Kew and corrected:

On the 10th at 4 p.m., a velocity of 5·5 should be 15.

Forty remeasurements of direction and velocity have been made with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 1·0 |
| (2.) Mean difference irrespective of sign | 0·3 | 0·6 |
| (3.) Residual difference (Aberdeen − Kew) | 0·0 | −0·1 |

*Armagh.*—The Armagh anemograph has been in good action during September, and the records are complete.

The following error has been corrected at Kew:

September 6, 7 p.m., direction 20·5 should be 25.

Forty remeasurements of direction and velocity have been made, with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference - - - | 1·0 | 1·0 |
| (2.) Mean difference irrespective of sign - | 0·3 | 0·3 |
| (3.) Residual difference (Armagh – Kew) - | +0·2 | +0·2 |

*Falmouth.*—The anemograph has been in good action during the month, and the records are quite complete. No error has been discovered at Kew.

Forty remeasurements of direction and velocity have been made, with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference - - - | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign - | 0·2 | 0·5 |
| (3.) Residual difference (Falmouth – Kew) - | 0·0 | −0·1 |

*Glasgow.*—The Glasgow anemograph has been in good action during September. The trace given by the direction pencil, however, is slightly defective, probably owing to the existence of stiffness in some parts.

The records are complete, and no error has been discovered.

Forty remeasurements of direction and velocity have been made, with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference - - - | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign - | 0·2 | 0·6 |
| (3.) Residual difference (Glasgow – Kew) - | 0·0 | 0·0 |

*Kew.*—The Kew anemograph has been in good action during September, and there are no deficiencies in the records, nor have any errors been detected by examination.

Forty remeasurements of direction and velocity have been made, with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference - - - | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign - | 0 1 | 0·7 |
| (3.) Residual difference ($Kew^1$ – $Kew^2$) - | 0·0 | −0·5 |

*Stonyhurst.*—The anemograph at this station has been in good action during September. The orientation was tested on the 22nd, and found correct. The records are complete.

The following errors in velocity were discovered and corrected at Kew.

September 10, 6 p.m., 13 should be 22.
„ 16, noon, 18 „ 28.

Forty remeasurements of direction and velocity have been made, with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference - - - | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign - | 0·3 | 0·6 |
| (3.) Residual difference (Stonyhurst – Kew) - | +0·1 | −0·1 |

*Valencia.*—The traces continue to show in places indications of stiffness in the movement of both direction and velocity pencils, otherwise the anemograph has been in good action during the month. From some cause not stated there was no curve on the sheet from 11 a.m. to 10 p.m. on the 28th, and in consequence twelve hourly records both of direction and velocity are lost.

At Kew the following errors in tabulation of velocity were discovered:

September 29, 11 p.m., 27 should be 22.
„ 30, 11 a.m., 20 „ 25.

Forty remeasurements of direction and velocity have been made, with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference - - - | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign - | 0·2 | 0·9 |
| (3.) Residual difference (Valencia–Kew) - | 0·0 | −0·1 |

## Barograph.

*Aberdeen.*—The action of the Aberdeen barograph has been good during this month; but the photography has been deficient, and in consequence of this readings have only been obtained to the nearest hundredth by means of the subsidiary tabulating instrument from September 12, 10 a.m., to 13, 8 p.m.

The following errors have been detected and put right:

In calculating residual correction—

September 7–8, +·002 should be +·001
„ 10–11, ·000 „ −·001
„ 16–17, +·005 „ +·006

Forty remeasurements have been made at Kew, with the following results:

| | |
|---|---|
| (1.) Greatest difference - - - - - - | 0·0050 |
| (2.) Mean difference irrespective of sign - - - | 0·0021 |
| (3.) Residual difference (Aberdeen–Kew) - - - | +0·0009 |

The mean monthly difference between simultaneous barograph and standard readings is ·0017.

*Armagh.*—The action of the Armagh barograph, as well as the photography, has been good, except that there is still bagging in the curves; but towards the end of the month there is a decided improvement in several of the curves.

The records are quite complete.

The following errors have been detected and corrected:

In entry of standard reading—

September 17, 10 a.m., 29·312 should be 29·320.

In tabulation, discovered by subsidiary tables—

September 30, midnight, 29·366 should be 29·316
„ 18, 1 p.m., 28·858 „ 28·808

In calculating residual correction—

September 1, 11 a.m. to midnight, +·029 should be +·026
„ 6–7 - - - +·025 „ +·026

In application of residual correction—

September 7, 1 p.m., 29·530 should be 29·430

Forty remeasurements have been made at Kew, with the following results:

| | |
|---|---|
| (1.) Greatest difference - - - - - | 0·0060 |
| (2.) Mean difference irrespective of sign - - - | 0·0021 |
| (3.) Residual difference (Armagh—Kew) - - - | +0·0005 |

The mean monthly difference between simultaneous standard and barograph readings is ·0026.

*Falmouth.*—The barograph at this station has been in good action during the month of September; the photography has also been good, with the exception of one or two sheets at the beginning of the month, which are somewhat discoloured.

The records are quite complete.

The following errors have been detected and put right:

In calculating residual correction—

September 13, to 10 a.m., +·004 should be +·005.

In application of residual correction—

September 21, 11 a.m. to midnight, −·007 was applied instead of −·008.

Forty remeasurements have been made at Kew, with the following results:

| | |
|---|---|
| (1.) Greatest difference - - - - - | 0·0060 |
| (2.) Mean difference irrespective of sign - - - | 0·0025 |
| (3.) Residual difference (Falmouth—Kew) - - - | +0·0006 |

The mean monthly difference between simultaneous standard and barograph readings is ·0022.

*Glasgow.*—The action of the barograph at this station has been good for the month of September, excepting occasional failures of the action of the clockstop. The photography has been deficient. No trace appeared on developing sheet No. 256–257, in consequence of which 37 hourly records have been lost. Standard readings of the barometer having been taken, 11 hourly values were secured for these days.

Sunday, 11th, 9 p.m., one hourly record lost on account of photographic blemish.

In all 38 hourly values have been lost..

The following errors have been detected and corrected:

In calculating residual correction—

Sebptemer 11, 11 a.m. to midnight, +·015 should be +·013.

In application of residual correction—

September 9, 10 a.m. 29·442 should be 29·432
„ 17, 6 p.m. 29·191 „ 29·201
„ „ 8 p.m. 29·171 „ 29·168
„ 30, 3 a.m. 29·494 „ 29·504
„ „ 11 p.m. 29·490 „ 29·500

Forty remeasurements have been made at Kew, with the following results:

| | |
|---|---|
| (1.) Greatest difference - - - - - | 0·0050 |
| (2.) Mean difference irrespective of sign - - - | 0·0018 |
| (3.) Residual difference (Glasgow—Kew) - - - | +0·0007 |

The mean monthly difference between simultaneous standard and barograph readings is ·0020.

*Kew.*—The barograph at this station has been in good action during this month, and the photography has been very good. The gas, however, was very low on the 8th of September at 3 and 4 a.m., in consequence of which the curve is very faint for those hours; but measurements have been made to the nearest hundredth by means of the subsidiary tabulating instrument.

The records are otherwise complete.

The following errors have been detected and put right:

In tabulation discovered by subsidiary tables—

September 13, 3 p.m. 29·301 should be 29·401
„ 13, 4 p.m., 29·348 should be 29·448

In applying residual correction—

September 4, 2 p.m., 29·823 should be 29·833
„ 11, 9 p.m., 29·390 „ 29·290

Forty remeasurements have been made at Kew, with the following results:

| | |
|---|---|
| (1.) Greatest difference - - - - - | 0·0050 |
| (2.) Mean difference irrespective of sign - - - | 0·0020 |
| (3.) Residual difference (Kew[1]—Kew[2]) - - - | —0·0003 |

The mean monthly difference between simultaneous standard and barograph readings is ·0017.

*Stonyhurst.*—The Stonyhurst barograph has been in good action during the month of September, but the photography has been deficient. Sheets 252–353, 256–257 are too indistinct to be measured with the tabulating instrument, but measurements have been made at Kew to the nearest hundredth; however two hourly records on the 12th and one on the 14th have been lost, no trace being visible.

The following errors have been detected and corrected:

In applying residual correction—

September 15, 8 a.m., 29·152 should be 29·052
„ 26, 7 p.m., 29.419 „ 29·519
„ 27, midt., 29·543 „ 29·453
„ 29, 7 p.m., 29·162 „ 29·182
„ „ midt., 29·157 „ 29·257

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference - - - - - | 0·0040 |
| (2.) Mean difference irrespective of sign - - - | 0·0017 |
| (3.) Residual difference (Stonyhurst—Kew) - - - | —0·0012 |

The mean monthly difference between simultaneous barograph and standard readings is ·0026.

*Valencia.*—The action of the Valencia barograph has been good during this month. The photography has also been good.

The records are quite complete.

The following errors have been detected and corrected:

In calculating residual correction—

September 4, 11 a.m. to midt., —·011 should be —·010
„ 5, 1 a.m. to 10 a.m., —·011 „ —·010
„ 5, 6 a.m., —·012 „ —·010
„ 30, 11 a.m. to midt., —·001 „ —·002

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference - - - - - | 0·0060 |
| (2.) Mean difference irrespective of sign - - - | 0·0019 |
| (3.) Residual difference (Valencia—Kew) - - - | +0·0009 |

The mean monthly difference between simultaneous barograph and standard readings is ·0023.

## Thermograph.

*Aberdeen.*—The Aberdeen thermograph has been in good action during September, but the photography has been somewhat indifferent. The records of the dry bulb thermometer are complete, but in consequence of failure of action two hourly records of the wet bulb were lost on the 11th.

The following errors have been detected at Kew and rectified:

Error of tabulation—

September 21, 9 a.m., wet bulb, 55·0 should be 45·0
Maximum on 19th, 11.30 a.m., 53·7 should be 54·1 at 0.1 a.m.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - - | 0·2 | 0·2 |
| (2.) Mean difference irrespective of sign - - | 0·09 | 0·10 |
| (3.) Residual difference (Aberdeen—Kew) - - | —0·04 | +0·02 |

The mean monthly difference between simultaneous standard and tabulated readings was—

| Dry. | Wet. |
|---|---|
| 0·19 | 0·17 |

*Armagh.*—The thermograph at Armagh has been in good action; the photography has been good, and the records for both bulbs are quite complete.

The following errors have been discovered and put right:

Errors of tabulation—

| | | | | | | |
|---|---|---|---|---|---|---|
| September | 1, | 5 p.m., | wet bulb, | 51·7 | should be | 51·1 |
| „ | 2, | 7 a.m., | „ | 47·9 | „ | 47·2 |
| „ | 4, | 8 a.m., | dry bulb, | 55·7 | „ | 54·7 |
| „ | 9, | 1 p.m., | „ | 67·9 | „ | 66·9 |
| „ | 20, | 11 a.m., | wet bulb, | 53·0 | „ | 48·0 |
| „ | 21, | 4 a.m., | „ | 42·2 | „ | 45·0 |

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign - - | 0·16 | 0·19 |
| (3.) Residual difference (Armagh—Kew) - - | +0·01 | +0·07 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·15 | 0·16 |

*Falmouth.*—The thermograph at this station has been in good action, and the photography generally good. By stoppage of the clock one hourly record of both bulbs was lost on the 7th, and one hour was lost on the 30th by the lights being turned off. The wet bulb was out of action three hours on the 1st, three hours on the 13th, and two hours on the 19th.

No error has been detected at Kew.

Forty remeasurements have been made with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·2 | 0·2 |
| (2.) Mean difference irrespective of sign - - | 0·08 | 0·10 |
| (3.) Residual difference (Falmouth—Kew) - - | —0·02 | —0·09 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·06 | 0·08 |

*Glasgow.*—The Glasgow thermograph has been in good action during the month. The photography was defective in several instances, and in consequence of a blemish ten hourly records of both bulbs were lost on the 12th, and six of the dry and eight of the wet bulb were lost on the 13th. Failure of gas caused the loss of nine hours' trace of the wet bulb on the 9th, and it was out of action as follows: two hours on the 3rd, one hour on the 4th, two on the 18th, three on the 19th, and one on the 25th.

The following error was discovered and corrected:

Maximum, September 28, 0.25 p.m. 54·1 should be 10.25 p.m. 54·7

Forty remeasurements have been made at Kew wlth the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign- - - | 0·12 | 0·10 |
| (3.) Residual difference (Glasgow—Kew) - - - | —0·09 | —0·05 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·10 | 0·11 |

*Kew.*—The action of the Kew thermograph, as well as the photography, has been good during the month. The records of the dry bulb are complete, but in consequence of defective action the following hourly records of the wet bulb have been lost: thirteen on the 12th, nine on the 13th, ten on the 19th, and ten on the 20th.

No error has been discovered by examination.

Forty remeasurements have been made with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·2 | 0·2 |
| (2.) Mean difference irrespective of sign - - | 0·07 | 0·06 |
| (3.) Residual difference ($Kew^1$—$Kew^2$) - - | —0·05 | 0·00 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·09 | 0·12 |

*Stonyhurst.*—The thermograph at this station has been in good action during the month; and the photography has been good. The records for both bulbs are quite complete.

The following error has been detected at Kew and set right:

September 1, 5 p.m. wet bulb 52°·9 should be 53°·5

Forty remeasurements have been made, with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign - - | 0·15 | 0·17 |
| (3.) Residual difference (Stonyhurst—Kew) - - | —0·02 | +0·09 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·10 | 0.12 |

*Valencia.*—The Valencia thermograph has been in good action during September, and the photography has been good. The records for both bulbs are complete.

The wet bulb curves from 7th, 1 a.m., to 8th, 10 a.m.,and 20th, noon, to 21st, noon, have been retabulated at Kew, the original measurements having been made from an incorrect setting of the scale. Several small errrors have also been corrected in maxima and minima.

Forty remeasurements have been made, with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - - | 0·2 | 0·3 |
| (2.) Mean difference irrespective of sign - - | 0·11 | 0·17 |
| (3.) Residual difference (Valencia—Kew) - - | +0·01 | +0·09 |

The mean monthly difference between simultaneous standard and tabulated readings is—

| Dry. | Wet. |
|---|---|
| 0·15 | 0·16 |

In the following Table the number of hourly records lost during the month of September 1869 is exhibited:

| | Anemograph. | | Barograph. | Thermograph. | | |
|---|---|---|---|---|---|---|
| | | | | Dry. | Wet Bulb. | |
| | Direction. | Velocity. | | | Not in action. | Other causes. |
| Aberdeen - - - - | 24 | 24 | 0 | 0 | 2 | 0 |
| Armagh - - - - | 0 | 0 | 0 | 0 | 0 | 0 |
| Falmouth - - - - | 0 | 0 | 0 | 2 | 8 | 2 |
| Glasgow - - - - | 0 | 0 | 38 | 8 | 9 | 19 |
| Kew - - - - | 0 | 0 | 0 | 0 | 42 | 0 |
| Stonyhurst - - - | 0 | 0 | 3 | 0 | 0 | 0 |
| Valencia - - - - | 12 | 12 | 0 | 0 | 0 | 0 |

Mr. Scott reported that in order to accelerate the issue of telegraphic weather intelligence he had engaged an additional Commissionaire to attend daily at 11.15 and take out the messages at the cost of 4*s.* 6*d.* per week.—Approved.

Submitted. A specimen of the results yielded by Sir W. Thomson's electrometer, recently erected at Kew. (See Minutes 1867, p. 71.)

The following cheques were drawn, 25th October:

For Salaries for October :—

| | £ | *s.* | *d.* |
|---|---|---|---|
| R. H. Scott - - - - - - - | 66 | 13 | 4 |
| H. Toynbee - - - - - - - | 33 | 6 | 8 |
| B. Stewart - - - - - - - | 33 | 6 | 8 |
| W. Salmon - - - - - - - | 18 | 6 | 8 |
| J. S. Harding, jun. - - - - - - | 14 | 3 | 4 |
| R. Strachan - - - - - - - | *16 | 13 | 4 |
| S. Jeffery (4 weeks to 27th) - - - - - | 12 | 0 | 0 |
| F. Gaster - - - - - - - | 10 | 16 | 8 |
| C. Harding - - - - - - - | 9 | 3 | 4 |
| R. H. Curtis - - - - - - - | 7 | 10 | 0 |
| F. Steventon - - - - - - - | 6 | 13 | 4 |
| J. S. Harding, sen. (4 weeks to 27th) - - - | 7 | 14 | 0 |
| E. Magrath " " - - - - | 5 | 0 | 0 |
| A. D. Spencer " " - - - - | 5 | 0 | 0 |
| J. Curtis " " - - - - | 5 | 0 | 0 |
| W. G. James " " - - - - | 5 | 0 | 0 |
| G. G. Francis " " - - - - | 3 | 0 | 0 |
| F. Brodie " " - - - - | 3 | 0 | 0 |
| Carried forward - - - - | £262 | 7 | 4 |

* Including allowance for care of instruments.

| | | | £ | s. | d. |
|---|---|---|---|---|---|
| Brought forward | | | 262 | 7 | 4 |
| For Instruments:— | | | | | |
| P. Adie | | | 15 | 7 | 6 |
| L. P. Casella, M.O. account | 6 5 0 | | | | |
| Do. "A" do. | 25 4 0 | | | | |
| | | 31 | 9 | 0 | |
| Elliott Brothers, M.O. do. | 5 0 0 | | | | |
| Do. "A" do. | 9 18 0 | | | | |
| | | 14 | 18 | 0 | |
| J. J. Hicks, M.O. do. | 1 13 0 | | | | |
| Do. "A" do. | 3 10 6 | | | | |
| | | 5 | 3 | 6 | |
| Negretti & Zambra, M.O. do. | 3 1 4 | | | | |
| Do. "A" do. | 8 13 0 | | | | |
| | | 11 | 14 | 4 | |
| For Agencies:— | | | | | |
| H. J. Smart, Liverpool | | 5 | 12 | 8 | |
| For Telegraphy:— | | | | | |
| Electric Telegraph Company, special charges, September | | 15 | 8 | 5 | |
| Magnetic Telegraph Company, September account | | 58 | 7 | 11 | |
| Submarine do. do. | | 36 | 4 | 2 | |
| For Observatories:— | | | | | |
| T. R. Robinson, Armagh— | | | | | |
| Expenses during September quarter | | 10 | 2 | 3 | |
| C. Clouston, Orkney— | | | | | |
| Allowance for half-year to 30th September | 5 0 0 | | | | |
| For erection of new instrument | 10 0 0 | | | | |
| | | 15 | 0 | 0 | |
| T. Kerr, Valencia, salary for October | | 20 | 16 | 8 | |
| W. G. Schoof, repairing barograph | | 7 | 0 | 0 | |
| For Special Printing:— | | | | | |
| P. Adie, anemometer papers | | 3 | 6 | 8 | |
| For Contingencies:— | | | | | |
| R. H. Scott, extra work of staff | | 20 | 5 | 0 | |
| E. Stanford, advertisements | | 4 | 7 | 6 | |
| E. Higgs, packing cases | | 6 | 10 | 0 | |
| For Office Petty Expenses:— | | | | | |
| J. S. Harding, jun., on account | | 30 | 0 | 0 | |
| Total | | £574 | 0 | 11 | |

The following cheque was also drawn:

J. White, for a Thomson's electrometer, and fitting up ditto - £74 0 0

The Committee then adjourned.

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116, *Victoria Street, Monday, November* 1, 1869.

PRESENT:

Dr. W. A. Miller in the Chair.

Mr. De La Rue.

The Director and the Secretary to the Committee were in attendance.

Mr. Scott reported that the anemograph recently erected at Holyhead had not been working well, and that some repairs to it had become necessary. As access to the cups was very dangerous, owing to there being no platform on the dome of the lighthouse, he requested permission to have a ladder and small platform erected.

Resolved—That the repairs of the anemograph be executed, and a ladder erected, at a cost not exceeding 10*l.*

Mr. Scott reported that there was a considerable amount of anemometrical data lying partially unreduced in the office, viz.:

| | | |
|---|---|---|
| Bermuda | 10 years, | part printed in Meteorological Papers, No. 8. |
| Halifax | 2 „ | printed in Meteorological Papers, No. 13. |
| Ascension | 2 „ | |
| Orkney | 7 „ | |

Resolved—That the clerks be allowed to execute work at overtime, to the extent of 100*l.*, in reducing the above anemometrical observations.

Submitted—The observations made at Ascension Island 1863–5 by Lieutenant L. Rokeby, with the results of their discussion.

Resolved—That their publication be postponed until the discussion of the Atlantic observations now in hand is completed.

Mr. Duncan Bell was appointed a temporary clerk, at a salary of 15*s.* per week.

Mr. Scott reported, that in the month of August last, on the authority of the Chairman, a copy of the Atlantic pilot charts had been presented to Captain S. Brooks, S.S. "City of London," on Captain Toynbee's recommendation, in consideration of the excellence of his registers.—Approved.

Mr. Scott stated, that as Mr. Hayes, coast guard officer, Schull, had rendered very useful services to the office in connexion with Cape Clear telegraph station, he would request permission to present him with an aneroid barometer. Sanctioned.

Mr. Stewart reported that he had been able to make arrangements with Dr. Robinson that would render practicable the erection of a new anemograph at Armagh.

Resolved—That 100*l.* be placed at Mr. Stewart's disposal, to enable him to carry out these arrangements.

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SPECIAL MEETING.

13, *Ashley Place, November* 12, 1869.

PRESENT:

Sir E. Sabine in the Chair.

| | |
|---|---|
| Mr. Galton. | Captain Richards. |
| Mr. Gassiot. | Mr. Spottiswoode. |

Dr. W. A. Miller.

The Director was in attendance.

Dr. Stewart's letter of the 8th of October (Minutes, October 11) having been taken into consideration, it was resolved—That Dr. Stewart's resignation be accepted, and that he continue his services to the end of the financial year; but that he be not required to attend the meetings of the Committee unless specially summoned.

Resolved—That this Committee are prepared to make the following proposals to the Council of the British Association:

Either, I. That Kew be continued as one of the ordinary self-recording observatories, in which case the Committee would be prepared to allot to it annually 250*l.*:

Or, II. In addition to the foregoing work, that Kew be maintained as the central observatory for examination of the records and tabulations from all the observatories, in which case the Committee would be prepared to allot a further annual sum of 400*l.*

They would further wish to retain the services of Mr. Beckley when required, the Committee defraying his expenses and paying his salary while in their employment.

All extra work done, such as instruction of observers, trial of new instruments, construction of models, or experiments of any kind, to be paid for extra, as far as possible according to furnished and accepted estimates.

The verification of instruments belonging to the Meteorological Office to be carried on at Kew on the same terms as heretofore.

The Committee then adjourned.

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116, *Victoria Street, November* 15, 1869.

PRESENT:

Dr. W. A. Miller in the Chair.

Sir E. Sabine. | Mr. Galton.
Mr. Gassiot. | Mr. De La Rue.

Mr. Spottiswoode.

The Director was in attendance.

The minutes of the last three meetings were read and confirmed.

Submitted—The following Report:

GENTLEMEN,

IN carrying out the system for checking the telegraphic weather intelligence issued by the office in accordance with your resolution of the 26th of April (Minutes, p. 49), and in commencing the study of our weather and its changes, it has been found that the instrumental results and the weather reports from the seven observatories and from the telegraphic reporting stations are inadequate to represent fairly the weather experienced on all our coasts, it appears to me, therefore, very advisable that these should be supplemented by information from additional stations.

I have every reason to believe that a considerable number of good observers may be found who would most willingly send us observations, either regularly or occasionally in case of storms, and would only ask in return for a copy of the daily weather report. In some cases the issue of instruments on loan to observers might be desirable.

If the Committee approve of the suggestion, and would appoint a sub-committee to consider this important modification of our present system, it may be hoped that a satisfactory plan may be devised and set in operation.

ROBERT H. SCOTT.

A discussion having arisen with reference to the subject of the publication of the records furnished by the self-recording instruments, and their utilization in the discussion of weather, &c., Mr. Scott was directed to prepare a detailed report on the subject for consideration at the next meeting of the Committee.

Resolved—That Mr. Galton be requested to have constructed, without delay, an engraving pantograph for producing reversed templates (to be subsequently used in the ordinary pantograph), by which the reduction will be in one direction, namely, one-third in breadth.

Mr. Scott reported—That R. H. Barnes, Esq., 40, Kensington Park Gardens, and Captain E. Barnes, Bridlington, having recently erected anemographs (Robinson's pattern), had kindly consented to supply the office with tracings of their anemograms, on condition of receiving a copy of the daily weather reports.

Resolved—That Mr. Scott be authorized to supply the reports in exchange for the anemograms as requested, and also to other gentlemen who may supply information regularly to the office.

Reported—That at the request of Captain Sherard Osborn special telegrams had been sent to Captain Halpin while the Great Eastern lay at Portland, at the expense of the company. The telegrams had been sent twice daily from the office, as well as from Valencia and St. Ann's Head, Pembroke.—Action approved.

Mr. Scott requested permission to have the observations made at Cape Pembroke light-house, Falkland Islands, discussed by the clerks at extra hours.

Sanctioned—Expense not to exceed 10*l.*

Reported—That applications for telegraphic weather intelligence from Pembrey, Ventnor, Cork, Passage, and Queenstown, having been approved by the Board of Trade, the stations had been added to the list of stations warned.

Mr. Scott stated that, as Mr. F. Steventon had now been more than a year in the office, he requested permission to raise his salary for the present financial year to the rate of 90*l.* per annum, being an increase of 10*l.*

Approved—Increase to take effect at once.

Mr. Scott was directed to communicate to Dr. Stewart the resolution of the Committee passed on the occasion of his resignation.

A cheque for 15*l.*, on account of petty cash, was drawn.

The Committee then adjourned.

116, *Victoria Street, November* 29, 1869.

PRESENT:

Sir E. Sabine in the Chair.

| | |
|---|---|
| Mr. De La Rue. | Dr. W. A. Miller. |
| Mr. Galton. | Captain Richards. |
| Mr. Gassiot. | Mr. Spottiswoode. |

The Director was in attendance.

The Minutes of last meeting were read and confirmed.

Mr. Scott reported that he had communicated with Dr. Stewart, as directed at last meeting, and had received from him the papers, &c., which were in his charge.

The Director was instructed to inform the Board of Trade that the amount required by the Committee for the year 1870–71, would be 10,000*l.*, being the same sum as was voted for the present year.

Resolved—That the following detailed estimate be printed on the Minutes:—

METEOROLOGICAL OFFICE. ESTIMATE for Year 1870–71.

| | Voted for year 1869–70. | Proposed for 1870–71. |
|---|---|---|
| Salaries | £3,000 0 0 | £3,300 0 0 |
| Expenses of observatories | 2,000 0 0 | 2,000 0 0 |
| Instruments, mercantile marine | 400 0 0 | 250 0 0 |
| Do. Admiralty | 500 0 0 | 500 0 0 |
| Agencies at ports | 150 0 0 | 150 0 0 |
| Travelling | 150 0 0 | 150 0 0 |
| Telegraphy | 3,000 0 0 | 2,500 0 0 |
| Special printing | 100 0 0 | 150 0 0 |
| Office contingencies | 700 0 0 | |
| Rent and office expenses | | 500 0 0 |
| Other contingent expenses, including the construction of new instruments | | 500 0 0 |
| | £10,000 0 0 | £10,000 0 0 |

Mr. Scott submitted his Report, in accordance with instructions at the last meeting, and stated that he had received a letter from the Chairman on the subject.

Resolved—That the Report and letter in question be inserted on the Minutes as approved.

REPORT.

In accordance with your resolution of the 15th instant, I beg to submit a report on the utilization of the materials at the disposal of the office, so as to render the results obtained accessible to the public.

The question divides itself into three heads:—

I. Calculation of numerical results.

II. Publication of instrumental records in a graphical form.

III. Statistical inquiries with the view of discovering laws.

I. The publication of numerical results may be considered as of primary importance. Tables are now in process of calculation, in compliance with your resolution of June 7. Specimens of some of these tables have been published in your last annual report. The table for hourly periodic corrections of temperature is in hand, with the view to its publication at the end of five years.

No calculations relating to wind have as yet been undertaken.

The experience gained tends to show that the tables above mentioned, for all the observatories, for a year, may be completed in five months time by two clerks working under supervision. There is, therefore, ample time available for discussions regarding anemometry.

The present annual cost of this work, including the anemometry, in salaries, is 286*l.*

The tables to be printed in 4to., and to appear in connexion with the publication contemplated under Section II.

II. It is evident that materials will accrue from the observatories at a rate much quicker than that at which the office can discuss them, leaving out of question the variety of the points of view from which they may be utilized. It would therefore seem advisable to issue at regular intervals, quarterly

if possible, a publication entitled "Quarterly Weather Report of the Meteorological Office," to commence with January 1, 1869. This serial to contain complete graphical reproductions of the curves, as already contemplated by the Committee. With it might be combined, either in each issue or at the end of the year, the corresponding mean numerical results above referred to.

Such curves would, however, only be useful to scientific meteorologists. In order to render them intelligible to other readers, it would be necessary to furnish with the plates and tables some remarks on the weather which they represent. These might take the form of a weather summary for these islands and their immediate neighbourhood, somewhat of the nature of the Weekly Weather Summary now published on Thursdays. This might possibly, as suggested by Mr. Galton, be further illustrated by diagrams in the text, either representing remarkable daily isobaric charts, or portions of the continuous curves, to indicate the propagation of changes in the several elements across the area of these islands.

In order, however, to render such a summary a really trustworthy record of British weather, especially of its most important disturbances, additional information is required. The office at present receives from the observatories very little information as to the weather, the condition of the sky, &c. The telegraphic reports are not much better. However, all these stations, owing to their situation, only very imperfectly represent the changes which take place.

The office is without information from any point on the west coast of Ireland between Valencia and Greencastle. On the west coast of Scotland there is no station of any sort between the Clyde and the Pentland Firth. The east and south coasts of Great Britain are well covered with stations; but on the Irish Channel, if we except Armagh and Stonyhurst, the only information from points between Ardrossan and Penzance is from Liverpool, Holyhead, and St. Ann's Head.

To the eastward and southward, the daily reports published in Hamburg, Utrecht, and Paris give us trustworthy intelligence; but for our own country we must depend upon volunteer co-operation.

Such assistance could, I am confident, be obtained from several observers of well-known accuracy, who would only ask to receive in return a copy of the Daily Weather Report.

Their reports need not in the first instance have reference to instrumental readings, unless their instruments have been verified, but might be confined to a record of storms and sudden atmospherical changes experienced by them.

Had we such information our summaries would be greatly enhanced in value. Perhaps the observatories might be induced at least to follow Dr. Robinson's example, and to give the hours at which the observations of clouds, with their forms and motion, were made. A small additional allowance might be made for the extra work imposed on the assistants, which was evidently not contemplated when the "Rain and Weather Report" forms were drafted. Such information as to clouds, if accurate and minute enough, might well be printed in full, and would be most acceptable to many weather students.

I have no knowledge as to the probable expenditure of time, &c., required for working the pantograph, nor as to the expense of a publication such as I have suggested; but as the diagrams would scarcely be "fine wood-cuts," I understand that a page of plates would not be more expensive, as to press work, than one of type.

The Summary could be carried on by the present staff.

III. The foregoing suggestions relate solely to regular publications of the nature of a chronicle of facts, but it appears to me that the office should not rest content without undertaking the scientific investigation of weather.

Some such inquiries are regularly carried on at present in connexion with the issue of telegraphic weather intelligence. However, I should venture to suggest that examinations into the statistics of our weather, with reference to well-defined lines of inquiry, in order, if possible, to trace out laws, would be a course of action which might be sanctioned by the Committee.

No speculations of a theoretical nature to be admissible.

The results to be in each case submitted to the Committee for directions as to their disposal.

If their publication be in any case approved, such inquiries might appear as an appendix to the Quarterly Weather Report.

*Statistical Inquiries now in progress.*

Investigation of the weather of these islands, from November 27 to December 10, 1868.

Examination of the easterly storms felt on our coasts during the period, now nearly three years, for which weather charts have been drawn.

This work to be done by existing staff.

ROBERT H. SCOTT.

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MY DEAR SIR, 13, Ashley Place, November 25.

IN reference to Sect. I. of your Report on the Utilization of the Meteorological Materials in the office, would it not be desirable to add to the tables now in process of calculation others showing, I., the index of variability of the daily temperature, in the year, and in the different seasons of the year, at each of the seven observatories?

Might it not be also desirable to compute and exhibit the temperature and pressure of vapour under different winds in the course of the year, as was done by Mr. Manuel Johnson in the Observations of the Radcliffe Observatory, commencing I believe with 1854?

Sincerely yours,

EDWARD SABINE.

Submitted—A correspondence with Professor Mohn, of the Meteorological Institute, Christiania, respecting an exchange of telegrams between this country and Norway (see Minutes, p. 92.)

M. Mohn proposes to bear all charges outside the area of these islands, if the Meteorological Office will defray the charges for the land lines in the United Kingdom. The daily exchange of messages to be:—

| Norway to M.O. | | M.O. to Norway. | |
|---|---|---|---|
| 8 a.m. | Christiansund. | Nairn - | 8 a.m. |
| | Skudesnaes. | Valencia - | |
| | Oxö (Christiansand). | Yarmouth - | |
| 2 p.m. | Skudesnaes. | Nairn - | 2 p.m. |

In addition to the above, notice of storms to be sent when necessary.

Resolved—That this proposal be agreed to for one year.

Mr. Scott reported—That the Ministère de la Marine in Paris had placed that office in communication with the Observatoire Météorologique at Montsouris, and that M. Deville, the Director of that establishment, had notified to him that the telegraphic reports sent by the Ministère (Minutes 1867, p. 10*b*,) would in future be sent under his scientific superintendence.

Submitted—A letter from Dr. Carl Jelinek, of Vienna, conveying an intimation that it was proposed to hold a meteorological conference at Berne in 1870, and inviting the Committee to take part in it.

Mr. Scott was instructed to thank Dr. Jelinek for his information.

Read—An application from W. W. Rundell, Esq., of Liverpool, for permission to purchase a "station" barometer, value 5*l.* 10*s.*—Sanctioned.

Submitted—The following Report from Dr. Stewart, regarding the records for October 1869, received from the self-recording instruments of the various Observatories, and which have been examined at Kew, in accordance with the regulations adopted by the Meteorological Committee. (See Minutes, 21st December 1868.)

ANEMOGRAPH.

*Aberdeen.*—The anemograph at this station has been in good action during the month of October, and the records are quite complete.

No errors in tabulation have been discovered at Kew. The orientation was tested on October 14th and found correct.

Forty remeasurements have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference - - - | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign - | 0·3 | 0·7 |
| (3.) Residual difference (Aberdeen – Kew) - | 0·0 | + 0·3 |

*Armagh.*—The anemograph at this station has been in good action during this month, and the records are quite complete.

The following error in velocity was discovered and corrected at Kew:

October 15, 11 p.m., 24 should be 14.

Forty remeasurements have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference - - - | 1·0 | 1·0 |
| (2.) Mean difference irrespective of sign - | 0·4 | 0·3 |
| (3.) Residual difference (Armagh – Kew) - | +0·3 | 0·0 |

*Falmouth.*—The anemograph at this station has been in good action during the month of October, and the records are complete, with the exception of five hourly values of both velocity and direction, lost by a stoppage of the clock on the 5th October.

The orientation was tested on the 4th October and found correct.

Forty remeasurements have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference - - - | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign - | 0·3 | 0·7 |
| (3.) Residual difference (Falmouth – Kew) - | –0·2 | 0·0 |

*Glasgow.*—With the exception of faintness in the traces in several instances, the anemograph at the station has been in good action during the month of October, and the records are quite complete.

On curve No. 287 there is a difference of about 15 minutes between the times shown by curve and the chronometer, the cause of which is not explained.

The following error in direction has been discovered at Kew and corrected:

October 28, 9 p.m., 30 should be 32.

Forty remeasurements have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign | 0·0 | 0·5 |
| (3.) Residual difference (Glasgow—Kew) | 0·0 | −0·1 |

*Kew.*—The anemograph at this station has been in good action during the month of October; one hourly record of direction was lost on October 9th during the examination of the orientation at that time, and six hourly records of direction and seven of velocity were lost on October 27th, owing to a stoppage of the clock; with the above exceptions the records are complete.

No errors have been discovered by examination.

Forty remeasurements have been made with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign | 0·3 | 0·7 |
| (3.) Residual difference ($Kew^1$—$Kew^2$) | +0·1 | −0·2 |

*Stonyhurst.*—The anemograph at Stonyhurst has been in good action during the month of October, and the records are complete.

The following errors in velocity have been discovered at Kew and corrected:

October 23, 2 p.m., 25 should be 15.
„ 26, 11 a.m., 15 „ 25.
„ 31, 5 p.m., 31 „ 21.

Forty remeasurements of direction and velocity have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign | 0·1 | 0·5 |
| (3.) Residual difference (Stonyhurst—Kew) | 0·0 | 0·0 |

*Valencia.*—The anemograph at this station has been in good action during the month of October, and the records are quite complete.

The action of the direction pencil, however, still continues somewhat unsatisfactory.

The following errors have been detected at Kew and corrected:

In velocity:

October 15, 7 p.m., 19 should be 38.
„ 27, 4 p.m., 30 „ 18.
„ 28, 6 a.m., 10 „ 20.
„ 30. 8 p.m., 20 „ 10.

In direction:

October 28, 5 a.m., 29 should be 31.

Forty remeasurements have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign | 0·3 | 0·6 |
| (3.) Residual difference (Valencia—Kew) | 0·0 | +0·2 |

## Barograph.

*Aberdeen.*—The action of the barograph for October has been good, and with one exception the photography has been good. The records are quite complete. No errors have been discovered at Kew.

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0060 |
| (2.) Mean difference irrespective of sign | 0·0021 |
| (3.) Residual difference (Aberdeen—Kew) | −0·0009 |

The mean monthly difference between simultaneous and standard readings is 0·0018.

*Armagh.*—The action of the Armagh barograph, as well as the photography, have been good during this month. On October 15th and 20th the cylinder was started wrongly, and in consequence three hourly records are lost, and four rendered doubtful.

The following errors were discovered and corrected at Kew:

In entry of standard readings—

October 12, 4 p.m., should be at 8 p.m.
„ 18, 8 p.m., „ 4 p.m.
„ 10 p.m. omitted.

In calculating residual correction—

October 22-23 +·015 should be +·013

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0060 |
| (2.) Mean difference irrespective of sign | 0·0021 |
| (3.) Residual difference (Armagh—Kew) | +0·0017 |

The mean monthly difference between simultaneous barograph and standard readings is 0·0024.

*Falmouth.*—The action of the Falmouth barograph as well as the photography have been good during this month, and the records are quite complete.

The standard reading, October 18, 6 p.m., was omitted to be entered, and the residual correction on the 22nd of—·019 should be —·021.

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | ·0050 |
| (2.) Mean difference irrespective of sign | ·0018 |
| (3.) Residual difference (Falmouth—Kew) | —·0003 |

The mean monthly difference between simultaneous barograph and standard readings is 0·0018.

*Glasgow.*—The action of the Glasgow barograph as well as the photography for the month of October have been good, and the records are complete.

The following errors have been discovered at Kew and corrected:

In entry of standard readings—

October 23, 2 p.m., 30·044 should be 29·944.

In tabulation—

| | | | | | |
|---|---|---|---|---|---|
| October | 19, | 4 p.m., | 29·725 | should be | 29·825 |
| „ | „ | 5 p.m., | ·748 | „ | ·848 |
| „ | „ | 6 p.m., | ·776 | „ | ·876 |
| „ | „ | 7 p.m., | ·790 | „ | ·890 |

In calculating residual correction—

| | | | |
|---|---|---|---|
| October | 4–5 | +·010 should be | +·009 |
| „ | 7–8 | +·016 „ | +·018 |
| „ | 26–27 | +·017 „ | +·015 |

In applying residual correction—

October 18, 3 a.m., 29·160 should be 29·180.

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0060 |
| (2.) Mean difference irrespective of sign | 0·0018 |
| (3.) Residual difference (Glasgow—Kew) | +0·0012 |

The mean monthly difference between simultaneous barograph and standard readings is 0·0021.

*Kew.*—The action of the Kew barograph as well as the photography have been good during this month, and the records are complete.

The following errors have been discovered by examination:

In applying residual correction—

| | | | | | |
|---|---|---|---|---|---|
| October | 3, | mid., | 30·990 | should be | 30·090 |
| „ | 7, | 11 p.m., | 30·153 | „ | 30·123 |

Forty remeasurements have been made with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0040 |
| (2.) Mean difference irrespective of sign | 0·0018 |
| (3.) Residual difference ($Kew^1$—$Kew^2$) | +0·0010 |

The mean monthly difference between simultaneous barograph and standard readings is 0·0020.

*Stonyhurst.*—The action of the Stonyhurst barograph has been good during this month; but the photography on four occasions has been bad, and in consequence the following hourly records have been lost:

| | | |
|---|---|---|
| October | 16 | 11 hours. |
| „ | 17 | 21 „ |
| „ | 18 | 8 „ |
| „ | 26 | 10 „ |
| „ | 27 | 20 „ |
| „ | 28 | 8 „ |
| „ | 30 | 11 „ |
| „ | 31 | 21 „ |

In all, 110.

Also the following readings were only obtained to the nearest hundredth at Kew, as the curve was too indistinct to be measured with the ordinary tabulator:

| | | |
|---|---|---|
| October | 12 | 13 hours. |
| „ | 13 | 24 „ |
| „ | 14 | 11 „ |

The following error was detected at Kew and put right:

In calculating residual correction—

October 19–20, +·007 should be +·006

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | ·0050 |
| (2.) Mean difference irrespective of sign | ·0018 |
| (3.) Residual difference (Stonyhurst—Kew) | +·0002 |

The mean monthly difference between simultaneous barograph and standard readings is 0·0018.

*Valencia.*—The action of the Valencia barograph as well as the photography for the month of October have been good, and the records are complete.

The following errors have been detected at Kew and corrected:

In entry of standard readings—

| | | | |
|---|---|---|---|
| October | 3, 10 p.m., | 29·068 | should be 30·068 |
| „ | 23, 10 a.m., | 29·466 | „ 30·466 |
| „ | noon, | 29·460 | „ 30·460 |
| „ | 2 p.m., | 29·440 | „ 30·440 |
| „ | 4 p.m., | 29·413 | „ 30·413 |
| „ | 10 p.m., | 29·390 | „ 30·390 |

In calculating residual correction—

| | | | |
|---|---|---|---|
| October | 1 | −·001 | should be −·002 |
| „ | 1–2 | −·004 | „ −·003 |

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | ·0050 |
| (2.) Mean difference irrespective of sign | ·0010 |
| (3.) Residual difference (Valencia—Kew) | +·0009 |

The mean monthly difference between simultaneous barograph and standard readings is 0·0023.

## Thermograph.

*Aberdeen.*—The Aberdeen thermograph has been in good action through October, and the photography is good.

The gas having been extinguished by the entry of rain into the thermograph room, four hourly records of the dry bulb, and seven of the wet bulb, were lost on the 18th, and nine dry bulb and 14 of the wet bulb were lost on the 19th. Owing to the wet bulb being out of action, one hourly value was lost on the 14th, and through the action of frost five hours lost on the 17th, seven on the 19th, six on the 20th, four on the 26th, five on the 27th; and two on the 28th; and from indistinctness of curve three hourly values of the wet bulbs were lost on the 26th.

No error of importance has been discovered at Kew.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign | 0·12 | 0·11 |
| (3.) Residual difference (Aberdeen—Kew) | +0·02 | 0·08 |

The mean monthly difference between simultaneous standard and tabulated readings is:

| Dry. | Wet. |
|---|---|
| 0·14 | 0·15 |

*Armagh.*—The Armagh thermograph has been in good action through the month of October, and the photography has been good, and the records for both bulbs are quite complete.

The following errors have been discovered at Kew and corrected:

Errors of tabulation—

| | | | | | |
|---|---|---|---|---|---|
| October | 9, | 11 a.m., | dry bulb, | 60·0 | should be 60·8 |
| „ | „ | 1 p.m., | „ | 66·8 | „ 67·8 |
| „ | 8, | 2 a.m., | wet bulb, | 54·2 | „ 54·9 |
| „ | 10, | 1 a.m., | dry bulb, | 61·5 | „ 62·2 |
| „ | „ | 4 a.m., | „ | 55·6 | „ 56·1 |
| „ | „ | 9 a.m., | „ | 62·2 | „ 63·1 |
| „ | 16, | 9 a.m., | „ | 42·9 | „ 42·2 |
| „ | 20, | 9 a.m., | wet bulb, | 35·9 | „ 40·9 |

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign | 0·13 | 0·08 |
| (3.) Residual difference (Armagh—Kew) | −0·11 | +0·05 |

The mean monthly difference between simultaneous standard and tabulated readings is:

| Dry. | Wet. |
|---|---|
| 0·17 | 0·17 |

*Falmouth.*—The Falmouth thermograph has been in good action during this month, and the photography has been good. The records for the dry bulb are quite complete. On account of the wet bulb being out of action the following number of hourly records were lost:—October 5th two, 16th two, 17th ten, 19th two, 20th two, 22nd one, 24th one, and 29th three.

No errors have been detected at Kew.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference | 0·2 | 0·2 |
| (2.) Mean difference irrespective of sign | 0·07 | 0·08 |
| (3.) Residual difference (Falmouth—Kew) | —0·01 | 0·00 |

The mean monthly difference between simultaneous standard and tabulated readings is:

| Dry. | Wet. |
|---|---|
| 0·11 | 0·08 |

*Glasgow.*—The thermograph at this station has been in good action through the month. The photography has also been good. The dry bulb records are quite complete. Owing to the wet bulb being out of action, two hourly records were lost on the 17th, and through the action of frost one hourly value was lost on the 17th, fourteen on the 19th, four on the 20th, one on the 26th, five on the 27th, and five on the 28th.

No error has been detected at Kew.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign | 0·12 | 0·13 |
| (3.) Residual difference (Glasgow—Kew) | —0·03 | +0·06 |

The mean monthly difference between simultaneous standard and tabulated readings is:

| Dry. | Wet. |
|---|---|
| 0·09 | 0·08 |

*Kew.*—The thermograph has been in good action in the month of October, and the photography is good. The records for both bulbs are uite complete.

No errors have been discovered on examination.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference | 0·2 | 0·3 |
| (2.) Mean difference irrespective of sign | 0·10 | 0·10 |
| (3.) Residual difference ($Kew^1$—$Kew^2$) | —0·02 | 0·07 |

The mean monthly difference between simultaneous standard and tabulated readings is:

| Dry. | Wet. |
|---|---|
| 0·08 | 0·14 |

*Stonyhurst.*—The thermograph at this station has been in good action during the month of October, also the photography has been good. The dry bulb records are quite complete. On account of photographic blemish one hourly record of the wet bulb was lost on the 17th.

No errors of importance have been discovered at Kew.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference | 0·3 | 0·3 |
| (2.) Mean difference irrespective of sign | 0·11 | 0·14 |
| (3.) Residual difference (Stonyhurst—Kew) | —0·09 | —0·02 |

The mean monthly difference between simultaneous standard and tabulated readings is:

| Dry. | Wet. |
|---|---|
| 0·10 | 0·11 |

*Valencia.*—The thermograph at this station has been in good action during the month, and the photography has been good. The records for both bulbs are quite complete:

The following errors have been detected at Kew and put right:

In tabulation—

October 2, 6 a.m., dry bulb, 53·0 should be 52·0.

In minimum—

October 29, 1 a.m., 48·9 should be 0h. 10′ a.m., 46·4.

Forty remeasurements have been made at Kew, with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference | 0·2 | 0·3 |
| (2.) Mean difference irrespective of sign | 0·10 | 0·12 |
| (3.) Residual difference (Valencia—Kew) | —0·06 | —0·03 |

The mean monthly difference between simultaneous standard and tabulated readings is.

| Dry. | Wet. |
|---|---|
| 0·11 | 0·14 |

In the following Table the number of hourly records lost during the month of October 1869 is exhibited:—

| | Anemograph. | | Barograph. | Thermograph. | | | |
|---|---|---|---|---|---|---|---|
| | | | | Dry bulb. | Wet Bulb. | | |
| | Direction. | Velocity. | | | Not in action. | Frost. | Other causes. |
| Aberdeen - - | 0 | 0 | 0 | 13 | 1 | 29 | 24 |
| Armagh | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| Falmouth - - | 5 | 5 | 0 | 0 | 23 | 0 | 0 |
| Glasgow - - | 0 | 0 | 0 | 0 | 2 | 30 | 0 |
| Kew - - - | 7 | 7 | 0 | 0 | 0 | 0 | 0 |
| Stonyhurst - - | 0 | 0 | 110 | 0 | 0 | 0 | 1 |
| Valencia - - | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

The supply of a copy of the Daily Weather Reports to the following persons was approved:—

Dr. J. W. Moore, Dublin.
Dr. W. H. von Freeden, Hamburg.
R. Tennent, Esq., Edinburgh - } monthly.
Scottish Meteorological Society }

Permission was granted to order on the Mercantile Marine account—

25 sets of Thermometers
25 sets of Hydrometers.
6 Maximum Thermometers.
6 Minimum „

Mr. Scott was instructed to have these latter instruments tested at Kew.

Resolved—That the sum of 1000*l.* be transferred from the deposit account, London and Westminster Bank, to the current account of the Committee in the Bank of England.

The following cheques were drawn:

| | £ | *s.* | *d.* |
|---|---|---|---|
| For Salaries for November:— | | | |
| R. H. Scott - - - - - - - | 66 | 13 | 4 |
| H. Toynbee - - - - - - - | 33 | 6 | 8 |
| B. Stewart - - - - - - - | 33 | 6 | 8 |
| W. Salmon - - - - - - - | 18 | 6 | 8 |
| J. S. Harding, jun. - - - - - - | 14 | 3 | 4 |
| R. Strachan - - - - - - - | *16 | 13 | 4 |
| S. Jeffery (5 weeks to 1st December) - - - | 15 | 0 | 0 |
| F. Gaster - - - - - - - | 10 | 16 | 8 |
| C. Harding - - - - - - - | 9 | 3 | 4 |
| R. H. Curtis - - - - - - - | 7 | 10 | 0 |
| F. Steventon - - - - - - - | 7 | 1 | 8 |
| J. S. Harding, sen. (5 weeks to 1st December) - - | 9 | 12 | 6 |
| E. Magrath „ „ - - - - | 6 | 5 | 0 |
| A. D. Spencer „ „ - - - - | 6 | 5 | 0 |
| J. Curtis „ „ - - - - | 6 | 5 | 0 |
| W. G. James „ „ - - - - | 6 | 5 | 0 |
| G. G. Francis „ „ - - - - | 3 | 15 | 0 |
| F. Brodie „ „ - - - - | 3 | 15 | 0 |
| T. D. Bell, (3 weeks to 27th November) - - - | 2 | 5 | 0 |
| For Telegraphy:— | | | |
| Electric Telegraph Company, account for September - - | 87 | 15 | 8 |
| Magnetic do. do. October - - | 62 | 9 | 2 |
| Submarine do. do. do. - - | 37 | 0 | 3 |
| Carried forward - - - - | £463 | 14 | 3 |

* Including allowance for care of instruments.

| | | | £ | s. | d. |
|---|---|---|---|---|---|
| Brought forward - - - - - | | | 463 | 14 | 3 |
| For Expenses at Observatories :— | | | | | |
| J. J. Griffin & Sons :— | | | | | |
| Chemical Apparatus, Valencia - - - - | | | 3 | 17 | 8 |
| Hopkin & Williams :— | | | | | |
| Chemicals for Valencia - - - | 13 | 7 0 | | | |
| Do. Armagh - - - | 16 | 12 9 | | | |
| | | | 29 | 19 | 9 |
| T. Kerr, Valencia, salary for November - - - | | | 20 | 16 | 8 |
| For Contingencies :— | | | | | |
| E. Stanford, papers, &c. - - - - - | | | 2 | 6 | 1 |
| Js. Merrin, office fittings - - - - - | | | 7 | 0 | 0 |
| For Office Petty Expenses :— | | | | | |
| J. S. Harding, jun., on account - - - - | | | 30 | 0 | 0 |
| Total - - | | | £557 | 14 | 5 |

The Committee then adjourned.

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116, *Victoria Street, December* 6, 1869.

PRESENT:

Mr. Gassiot in the Chair.

Mr. De La Rue. | Mr. Galton.

Mr. Spottiswoode.

The Director was in attendance.

The Minutes of last meeting were read and confirmed.

Submitted—Forms to be supplied (I.) to the observatories in lieu of the present "Rain and Weather Report" forms, and (II.) to gentlemen who may be willing to supply the office gratuitously with reports of wind and weather at times of atmospherical disturbances.

The forms were approved, and Mr. Scott was instructed to have them printed, and to set the plan in operation for one year.

Submitted—Patterns of Lind's anemometer for use at the telegraph stations. No action was taken about these instruments.

Mr. Galton exhibited a model anemometer which he had invented, and Mr. Scott was instructed to have this instrument erected and tested for a time, and then to report to the Committee.

The question of the probability of some modification in the telegraphic arrangements of the office taking place after December 31st, 1869. Mr. Scott was instructed to place himself in communication with the Board of Trade in respect to this matter.

Read a letter from Dr. R. Angus Smith, of Manchester, asking if the office could assist him in procuring samples of rain water collected at various stations.

Mr. Scott was authorized to aid Dr. Smith in obtaining such samples.

Read a letter from Captain Toynbee, submitting the following logs for the consideration of the committee :—

Captain Hunter, S.S. "Alpha," Halifax to West Indies;
Captain Brown and Mr. Steven, S.S. "Moravian," Liverpool to Montreal;
Captain Watson, S.S. "Palmyra," Liverpool to New York;

and recommending Captains Hunter and Brown and Mr. Steven for copies of the Atlantic Pilot Charts, and Captain Watson (who has already received these charts, minutes, p. 61), for a letter conveying to him the marked thanks of the Committee for his very valuable co-operation.

The Committee then adjourned.

116, *Victoria Street, December* 20, 1869.

PRESENT:

Sir E. Sabine in the Chair.

Mr. Galton. | Mr. Gassiot.

The Director was in attendance.

The Minutes of last meeting were read and confirmed.

Reported—That in pursuance of instructions (Minutes, Nov. 29), the estimate for the year 1870-71 had been forwarded to the Board of Trade.

Mr. Scott submitted an extract from the Minutes of the Council of the British Association, which he had received from Mr. Gassiot, in reply to the resolution of this Committee passed on the 12th ult. (Minutes, p. 103), which was ordered to be printed.

EXTRACT from the MINUTES of the KEW COMMITTEE, 11th December 1869, approved by the Council of the British Association on same day.

The consideration of the relations between the Kew Observatory and Meteorological Office were considered. (Vide Minutes, p. 103.)

Resolved—

That it be recommended to the Council that Kew be continued as one of the ordinary self-recording observatories of the Meteorological Committee, that body allowing it annually 250*l.*

At present this work consists of obtaining traces of the Barograph, Thermograph, and Anemograph, and tabulating these, along with observations of raingauge and absolute hygrometer.

That in addition to the foregoing work, Kew be maintained as the central observatory for examination of the records and tabulations from all the other observatories for the further sum of 400*l.* per annum.

The method of examination not to differ materially from that at present adopted and described in the last report of the Meteorological Committee.

The Committee see no objection to continue to allow to the Meteorological Committee the occasional services of Mr. Beckley when required, the Meteorological Committee defraying his expenses and paying his salary while in their employment.

The Committee see no difficulty in continuing to undertake, from time to time, extra work for the Meteorological Committee, such as instruction of observers, trial of new instruments, construction of models, and experiments, the expense to be defrayed by the Meteorological Committee, upon estimates, whenever possible.

The verification of instruments belonging to the Meteorological Office to be carried on at Kew on the same terms as heretofore.

This arrangement not to take effect until 31st March 1870.

Should this report be approved by the Council a copy to be forwarded to the Meteorological Committee.

Reported—That through the kindness of the Dutch Government, the office had commenced to receive the telegraphic reports from Helder direct, instead of *viâ* Paris.

Mr. Scott was instructed to acquaint M. Le Verrier with the fact of his receiving the reports from Helder and Skudesnaes direct, with the view of the discontinuance of their supply through the Observatoire Impérial.

Read—A letter from Captain Toynbee, submitting an "excellent" register kept by Captain Fry, barque "Foam," of Bristol, assisted by his officers, Mr. Edward F. Gommo and Mr. William Thomas. The observations were carried on on the west coast of Africa, and were only interrupted for three days, when all three officers were ill with fever.

Resolved—That Mr. Scott be instructed to thank Captain Fry for his zealous and active co-operation (Minutes, 68, pp. 21 and 37), and to present him with a copy of the Atlantic Pilot Charts. An aneroid to be presented to each of the two officers, Messrs. Gommo and Thomas.

Resolved—On Captain Toynbee's suggestion, that the copies of the Atlantic Pilot Charts be ornamentally half bound, with labels outside stating that they were presentation copies; cost, 18*s.* per copy.

Submitted—A report from Dr. Balfour Stewart respecting a self-recording rain-gauge invented by Mr. Beckley, which had been erected at Kew and tested for three months.

Resolved—That Dr. Stewart be requested to continue his experiments on the apparatus for the present, furnishing the returns monthly.

Submitted—An application by Mr. Scott for instructions relative to an anemometer formerly at Ascension, and the property of the Government Grant Committee of the Royal Society. Part of the instrument is lying at Kew, and part at Mr. Adie's workshop.

Mr. Scott was instructed to have the instrument repaired and sent to the Meteorological Office.

Reported—That the Harbour Commissioners of Cork had purchased a fishery barometer at cost price.—Approved.

Reported—That copies of the Daily Weather Report were supplied to—
R. H. Barnes, Esq., Kensington.
W. Hosken Richards, Esq., Penzance.
Professor Buys Ballot, Utrecht.
Approved.

Mr. Galton reported that the drill pantograph now under construction by Mr. Beck (Minutes, Nov. 16, 1869) is far advanced, and works very satisfactorily.

Resolved—That Mr. Beck be instructed to add to the instrument an adjustment, as designed by Mr. Galton, to vary the proportions of the movements of the drill and tracer within small limits, in order to reduce the somewhat varying scales (in depth) of the tracings of the different observatories to precisely the same size.

Mr. Scott was authorized to engage a clerk for the special service of attending to this instrument.

Reported—That the model anemometer had been erected at the office for the purpose of testing it, as directed at last meeting.

Mr. Galton submitted a model anemoscope on the principle of the governor of a steam engine, and 10*l.* was placed at his disposal to have such an instrument made.

Submitted the following report from Mr. Stewart regarding the records for November 1869, received from the self-recording instruments of the various observatories, and which have been examined at Kew in accordance with the regulations adopted by the Meteorological Committee. (See Minutes, 21st December 1868.)

ANEMOGRAPH.

*Aberdeen.*—The anemograph at this station has been in good action during the month, and the records are quite complete. No error in tabulation has been discovered at Kew.

Forty remeasurements of velocity and direction have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign | 0·2 | 0·6 |
| (3.) Residual difference (Aberdeen—Kew) | 0·0 | +0·2 |

*Armagh.*—The anemograph at this station has been in good action during this month. Eight hourly values of velocity were lost on the 13th November, the paper being torn by the pencil, otherwise the records are complete. No error has been detected at Kew.

Forty remeasurements have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 1·0 |
| (2.) Mean difference irrespective of sign | 0·4 | 0·5 |
| (3.) Residual difference (Armagh—Kew) | +0·3 | +0·1 |

*Falmouth.*—The anemograph at this station has been in good action during the month of November, and the records are complete. The orientation was tested on November 12th, and found correct. No error has been discovered at Kew.

Forty remeasurements of direction and velocity have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign | 0·1 | 0·7 |
| (3.) Residual difference (Falmouth—Kew) | +0·1 | +0·5 |

*Glasgow.*—The anemograph has been in good action for this month, although several of the velocity traces are somewhat faint; 24 hourly records of both direction and velocity were lost on the 18th to 19th, by an omission to put the pencil in contact with the paper when the sheet was changed. The orientation was tested on the 1st November, and found correct.

The following errors have been discovered by examination:

In velocity—

| | | | | |
|---|---|---|---|---|
| November | 9, 3 p.m., | 13 | should be | 18 |
| „ | „ 5 p.m., | 19 | „ | 11 |
| „ | „ 7 p.m., | 29 | „ | 19 |
| „ | „ 8 p.m., | 28 | „ | 24 |
| „ | „ 9 p.m., | 19 | „ | 13 |
| „ | „ 10 p.m., | 13 | „ | 19 |

In direction—

November 11, 11 a.m., 30 should be 28.

Several small errors in subtraction were likewise detected in the subsidiary tables.

Forty remeasurements of direction and velocity have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 1·0 |
| (2.) Mean difference irrespective of sign | 0·2 | 0·5 |
| (3.) Residual difference (Glasgow—Kew) | 0·0 | 0·0 |

*Kew.*—The anemograph has been in good action for the month, and the records are complete.

No error has been detected on examination.

Forty remeasurements of direction and velocity have been made with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign | 0·1 | 0·7 |
| (3.) Residual difference | 0·0 | —0·2 |

*Stonyhurst.*—The Stonyhurst anemograph has been in good action during the month, and the records are complete. The orientation was tested on the 27th November and found correct. The following errors have been discovered at Kew and put right:

In direction—

| | | | | |
|---|---|---|---|---|
| November | 3, 10 a.m., | 24 | should be | 26 |
| „ | 23, 6 p.m., | 32 | „ | 2 |
| „ | 24, 3 p.m., | 1 | „ | 3 |
| „ | 29, 3 p.m., | 15 | „ | 17 |

In velocity—

| | | | | |
|---|---|---|---|---|
| November | 3, 9 p.m., | 4 | should be | 10 |
| „ | 4, 6 a.m., | 31 | „ | 40 |

Forty remeasurements of velocity and direction have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign | 0·1 | 0·6 |
| (3.) Residual difference (Stonyhurst—Kew) | +0·1 | +0·1 |

*Valencia.*—The anemograph at this station has been in good action during this month, with the exception of one hourly value of both direction and velocity lost on the 11th November by the stoppage of clock; the records are complete.

The following errors have been detected at Kew and put right:

In velocity—

| | | | | |
|---|---|---|---|---|
| November | 4, 11 a.m., | 20 | should be | 26 |
| „ | 12, 11 a.m., | 26 | „ | 20 |
| „ | 15, 1 a.m., | 20 | „ | 25 |
| „ | „ 2 p.m., | 45 | „ | 50 |
| „ | „ 5 p.m., | 45 | „ | 50 |
| „ | „ 9 p.m., | 50 | „ | 40 |
| „ | 29, 8 a.m., | 19 | „ | 30 |
| „ | „ 10 a.m., | 34 | „ | 30 |
| „ | „ 3 p.m., | 28 | „ | 23 |

Forty remeasurements of velocity and direction have been made at Kew with the following results:

| | Direction. | Velocity. |
|---|---|---|
| (1.) Greatest difference | 1·0 | 2·0 |
| (2.) Mean difference irrespective of sign | 0·2 | 0·5 |
| (3.) Residual difference (Valencia—Kew) | 0·0 | +0·4 |

## Barograph.

*Aberdeen.*—The action of the Aberdeen barograph, as well as the photography, for the month of November, have been good. The instrument was stopped from 11 a.m. on November 15th, to 4 p.m.

on the 16th, in consequence of breakage of the cylinder clamps. Six readings of the standard barometer were taken in the interval, but 24 hourly values were lost.

The following errors were detected at Kew and corrected:

In calculating residual correction—

November 4–5, −·002 should be −·001.

In applying residual correction—

November 4, 5 a.m., 29·006 should be 29·016.
„ 12, midt., 29·585 „ 29·485.

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0060 |
| (2.) Mean difference irrespective of sign | 0·0021 |
| (3.) Residual difference (Aberdeen—Kew) | −0·0012 |

The mean monthly difference between simultaneous barograph and standard readings is 0·0022.

*Armagh.*—The action of the barograph, as well as the photography, for this month, have been good. There remains still an indication of bagging at the commencement of the curves, but to a much smaller extent than some few months since. The records are complete.

The following errors have been detected at Kew and corrected:

In entry of standard readings—

November 27th, 8 p.m., reading entered at 4 p.m.

In tabulation—

November 23d, 10 a.m. 23·224 should be 29·241.

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0060 |
| (2.) Mean difference irrespective of sign | 0·0021 |
| (3.) Residual difference (Armagh—Kew) | +0·0004 |

The mean monthly difference between simultaneous barograph and standard readings is 0·0025.

*Falmouth.*—The action of the Falmouth barograph, as well as the photography, for the month of November, have been good, and the records are quite complete.

The following errors have been detected at Kew and put right:

In entry of standard readings—

November 3, 10 a.m., 30·024 should be 29·924
„ 29, 10 a.m., 29·652 „ 29·787

In calculating residual correction—

November 22–23, −·002 should be +·002

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0060 |
| (2.) Mean difference irrespective of sign | 0·0019 |
| (3.) Residual difference (Falmouth—Kew) | +0·0006 |

The mean monthly difference between simultaneous barograph and standard readings is 0·0019.

*Glasgow.*—The action of the Glasgow barograph, as well as the photography, have been good for November, and the records are complete.

The following errors have been detected at Kew and corrected:

In calculating residual correction—

November 2–3, +·012 should be +·008

In applying residual correction—

November 27, 9 p.m., 29·295 should be 29·305

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0060 |
| (2.) Mean difference irrespective of sign | 0·0024 |
| (3.) Residual difference (Glasgow—Kew) | −0·0005 |

The mean monthly difference between simultaneous barograph and standard readings is 0·0023.

*Kew.*—The action of the barograph, as well as the photography, have been good for this month, and the records are complete.

The following errors have been discovered by examination:

In calculating residual correction—

November 7–8, −·003 should be −·002
„ 8–9, −·004 „ −·002

Forty remeasurements have been made with the following results:

| | |
|---|---|
| (1.) Greatest difference | 0·0060 |
| (2.) Mean difference irrespective of sign | 0·0027 |
| (3.) Residual difference ($Kew^1 - Kew^2$) | +0·0013 |

The mean monthly difference between simultaneous barograph and standard readings is 0·0020.

*Stonyhurst.*—The action of the Stonyhurst barograph has been good, but the photography has been at fault on three occasions, and in consequence eight hourly values were lost on the 1st November, one on the 29th and three on the 21st, which could only be measured at Kew to the nearest hundredth.

The following errors have been discovered at Kew and corrected:

In calculating residual correction—

November 27, +·006 should be +·004

In applying residual correction—

November 13, noon, 29·430 should be 29·440
„ 26, 2 a.m., 29·300 „ 29·230

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference - - - - | 0·0050 |
| (2.) Mean difference irrespective of sign - - | 0·0019 |
| (3.) Residual difference (Stonyhurst−Kew) - - | +0·0011 |

The mean monthly difference between simultaneous barograph and standard readings is 0·0021.

*Valencia.*—The action of the barograph at this station, as well as the photography, have been good, but the light has failed on several occasions during the month, and from this cause four hourly values are lost on the 21st November. The records are otherwise complete.

The following errors have been detected at Kew and put right:

In entry of standard readings—

November 25, 10 p.m., 29·805 should be 29·905
„ 28, 10 p.m., 29·111 „ 30·111

In calculating residual correction—

November 6–7, +·007 should be +·008
„ 14–15, −·021 „ −·020

In applying residual correction—

November 2, 9 a.m., 30·453 should be 30·433
„ „ 10 a.m., 30·441 „ 30·425
„ 10, 8 p.m., 30·253 „ 30·263
„ 11, 1 a.m., 30·317 „ 30·307
„ 16, 6 p.m., 29·019 „ 30·019

Forty remeasurements have been made at Kew with the following results:

| | |
|---|---|
| (1.) Greatest difference - - - - | 0·0050 |
| (2.) Mean difference irrespective of sign - - | 0·0025 |
| (3.) Residual difference (Valencia−Kew) - - | + 0·0007 |

The mean monthly difference between simultaneous barograph and standard readings is 0·0021.

## Thermograph.

*Aberdeen.*—The Aberdeen thermograph has been in good action through November, and the photography has been good. The records of the dry bulb are complete. The following hourly records of the wet bulb are lost, owing to the action of frost: one on the 6th, seven on the 7th, one on the 9th, three on the 10th, five on the 11th, one on the 28th, one on 29th, and six on 30th; in all 25.

No error has been discovered at Kew.

Forty remeasurements have been made, with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference - - - - | 0·30 | 0·30 |
| (2.) Mean difference irrespective of sign - - - | 0·08 | 0·11 |
| (3.) Residual difference (Aberdeen−Kew) - - | +0·03 | +0·06 |

The mean monthly difference between simultaneous standard and tabulated readings is:

| Dry. | Wet. |
|---|---|
| 0·11 | 0·14 |

*Armagh.*—The thermograph at this station has been in good action during the month, and the photography has been good. Two hourly values of both bulbs were lost on the 22d, by a wrong setting of the cylinder. With this exception the records of the dry bulb are complete. Two hourly records of the wet bulb were lost, in addition to the preceding, through the action of frost, on the 30th.

The following errors have been detected at Kew and corrected:

Nov. 8, 1 p.m., dry bulb, 46·2 should be 45·4
5 p.m., wet bulb, 39·2 „ 40·2
9, mid., dry bulb, 35·2 „ 34·3
16, 4 p.m., wet bulb, 43·6 „ 45·6
17, 2 a.m., „ 40·4 „ 39·9
18, 2 a.m., „ 51·4 „ 52·4
19, 4 a.m., dry bulb, 50·7 „ 50·0
30, 7 a.m., „ 30·9 „ 30·2

Maximum—

22, 1·35 p.m., 41·7 should be 0·1 a.m. 42·9

It was also found necessary to retabulate the wet bulb from 18th, 1 a.m., to 19th, 10 a.m., the original measurements starting from an incorrect standard reading.

Forty remeasurements have been made with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference | 0·30 | 0·30 |
| (2.) Mean difference irrespective of sign | 0·12 | 0·11 |
| (3.) Residual difference (Armagh−Kew) | −0·01 | −0·07 |

The mean monthly difference between simultaneous standard and tabulated readings is

| Dry. | Wet. |
|---|---|
| 0·13 | 0·13 |

*Falmouth.*—The Falmouth thermograph has been in good action during November, and the photography is good. The records of the dry bulb are complete. The wet bulb was out of action at various times on the 2d, 4th, 13th, 28th, and 29th, causing thereby the loss of nine hourly values.

No error has been detected at Kew.

Forty remeasurements have been made with the following results:

| | Wet. | Dry. |
|---|---|---|
| (1.) Greatest difference | 0·30 | 0·30 |
| (2.) Mean difference irrespective of sign | 0·12 | 0·11 |
| (3.) Residual difference (Falmouth−Kew) | −0·01 | +0·03 |

The mean monthly difference between simultaneous standard and tabulated readings is:

| Dry. | Wet. |
|---|---|
| 0·07 | 0·07 |

*Glasgow.*—The thermograph at this station has been in good action during the month, and the photography has been good. The records of the dry bulb are complete. The following hourly values of the wet bulb were lost through the action of frost, one on the 9th, seven on the 10th, three on the 11th, six on the 23d, five on the 24th, three on the 25th, two on the 28th, two on the 29th, and one on the 30th; in all 28.

The following errors have been discovered and put right in tabulation:

Nov. 1st, 1 a.m., wet bulb, 44·0 should be 44·6
Maximum on 22d, 41·7 at 2·5 p.m., should be 44·9 at 1 a.m.

Forty remeasurements have been made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference | 0·30 | 0·30 |
| (2.) Mean difference irrespective of sign | 0·12 | 0·11 |
| (3.) Residual difference (Glasgow−Kew) | +0·04 | −0·03 |

The mean monthly difference between simultaneous standard and tabulated readings is:

| Dry. | Wet. |
|---|---|
| 0·09 | 0·12 |

*Kew.*—The Kew thermograph has been in good action during the month, and the photography has also been good. With the exception of one hourly value on both the 11th and 12th, when the wet bulb was out of action through frost, the records of both bulbs are complete.

The following error was discovered by examination in tabulation:

Nov. 1st, 9 a.m., 39·6 should be 44·6

Forty remeasurements have been made with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference | 0·30 | 0·20 |
| (2.) Mean difference irrespective of sign | 0·06 | 0·08 |
| (3.) Residual difference ($Kew^1 - Kew^2$) | +0·04 | −0·05 |

The mean monthly difference between simultaneous standard and tabulated readings is:

| Dry. | Wet. |
|---|---|
| 0·06 | 0·08 |

*Stonyhurst.*—The thermograph at this station has been in good action during the month, the photography also, with one exception, has been good. The records of the dry bulb are complete, but the wet bulb failed for three hours on the 10th, and three hours on the 23d, frost being the cause of failure in both cases.

No error has been detected by examination at Kew.

Forty remeasurements have been made with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference | 0·30 | 0·20 |
| (2.) Mean difference irrespective of sign | 0·09 | 0·07 |
| (3.) Residual difference (Stonyhurst−Kew) | −0·07 | 0·00 |

The mean monthly difference between simultaneous standard and tabulated readings is:

| Dry. | Wet. |
|---|---|
| 0·09 | 0·11 |

*Valencia.*—The action of the thermograph at this station as well as the photography has been good during November, and the records for both bulbs are without any deficiencies.

The following errors have been discovered at Kew and rectified:

In entry of standard readings:

7th, 10 a.m., dry bulb, 46·5 should be 45·6.
9th, 10 p.m., wet bulb, 44·4 „ 44·0.

In tabulation:

Maximum, 6th, 2 p.m., 52·5 should be 0·1 a.m. 53·2
Minimum, 9th, 8 p.m., 45·1 „ midt. 44·2
Wet bulb, 21st, 1 p.m., 52·6 „ 51·6

The last error was found to exist also in the subsidiary measurements, and thus remained undiscovered by that means.

It was found necessary to retabulate at Kew the dry bulb readings from 1 to 10 a.m. on the 17th, also those of the wet bulb from 11 a.m. of the 15th to 10 a.m. of the 17th.

Forty remeasurements were made at Kew with the following results:

| | Dry. | Wet. |
|---|---|---|
| (1.) Greatest difference | 0·30 | 0·30 |
| (2.) Mean difference irrespective of sign | 0·09 | 0·13 |
| (3.) Residual difference (Valencia—Kew) | −0·05 | 0·00 |

The mean monthly difference between simultaneous standard and tabulated readings is:

| Dry. | Wet. |
|---|---|
| 0·14 | 0·15 |

In the following Table the number of hourly records lost during the month of November is exhibited.

| — | Anemograph. | | Barograph. | Thermograph. | | | |
|---|---|---|---|---|---|---|---|
| | | | | Dry Bulb. | Wet Bulb. | | |
| | Direction. | Velocity. | | | Out of Action. | Frost. | Other Causes. |
| Aberdeen | 0 | 0 | 24 | 0 | 0 | 25 | 0 |
| Armagh | 0 | 8 | 0 | 2 | 0 | 2 | 2 |
| Falmouth | 0 | 0 | 0 | 0 | 9 | 0 | 0 |
| Glasgow | 24 | 24 | 0 | 0 | 0 | 28 | 0 |
| Kew | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| Stonyhurst | 0 | 0 | 9 | 0 | 0 | 6 | 0 |
| Valencia | 1 | 1 | 4 | 0 | 0 | 0 | 0 |

The Committee then adjourned.

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